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Chas. A. Browne







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## SENATE . . . . No. 58.

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### Commonwealth of Massachusetts.

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#### MEMORANDUM OF AN AGREEMENT

*Made at Boston on the twenty-fourth day of December, A. D. 1868, between WALTER SHANLY, of Montreal, and FRANCIS SHANLY, of Toronto, Canada, parties of the first part, and the COMMONWEALTH OF MASSACHUSETTS, party of the second part.*

The parties of the first part hereby covenant and agree with the said Commonwealth to do and perform all the work necessary to complete the Hoosac Tunnel, with its Central Shaft (being a portion of the Troy and Greenfield Railroad), in accordance with the schedule hereunto appended, and furnish all materials, and lay down and complete through the whole length of the tunnel one railroad track, and after the completion of the tunnel and railroad track to remove from the tunnel all materials and other things, so as to leave the tunnel and railroad track in complete order, ready for use, and to the satisfaction of the governor and council of the Commonwealth; the whole to be done by the 1st day of March, A. D. 1874, and for the sum of four million five hundred and ninety-four thousand two hundred and sixty-eight dollars (\$4,594,268), to be paid, together with any interest accruing under his contract,



by the Commonwealth to the parties of the first part, their heirs, executors, administrators or assigns, in United States Treasury notes, or other current funds, as hereinafter provided.

The size and general description of the work; the estimated amount of the same; the regulations governing the manner of its performance; the rates of progress required in its prosecution; and various general and particular stipulations and provisions affecting and binding both parties hereto, are set forth in the schedule hereunto appended, which constitutes a part of this agreement. But no errors in the estimates of the work to be done and materials to be furnished under this contract, shall affect the contract price to be paid for the whole work.

The parties of the first part will provide suitable and sufficient materials and machinery, and a sufficient and competent working force, and enter upon the prosecution of the work as soon as possible after the execution of this agreement, and will keep on hand and in operation at all times every means necessary to an expeditious and thorough fulfilment of this agreement on their part, according to its true intent and meaning.

And whereas, in consequence of the stopping of the work at the several points of operation, and for other reasons, the parties of the first part may not be able at the commencement to make the rate of progress prescribed in the schedule hereunto appended, it is agreed that the governor and council may fix the time from and after which such rate of progress shall be made, and give notice thereof to the parties of the first part; which time, however, shall not be earlier than the 1st day of May next.

And whereas that portion of the tunnel which lies between the west and central shafts is expected to require a longer time for its construction than the other portions thereof, and difficulties now unexpected may arise, making it impossible to preserve the said prescribed rate of progress in other portions of the tunnel, it is agreed that in case of necessity the governor and council may by formal vote determine what extension of time shall be allowed; provided, however, that in no case shall the final completion of the whole work be delayed more than six months after the 1st day of March, A. D. 1874.

And if, after a full and fair opportunity has been had by the parties of the first part, the rates of progress prescribed by the schedule hereunto appended have not been made, and it shall plainly appear to the governor and council that the parties of the first part are and will be unable to make such rates of progress, on the average, the governor and council, after giving to the parties of



the first part three months' notice in writing of their intention to do so, may, if their default continues, put an end to this contract, and resume possession of the work, and of all the shops, dwelling-houses, buildings, machinery, tools, and all the property whatsoever, belonging to the Commonwealth, which may have been delivered to the parties of the first part for use under this agreement.

The engineer or engineers of the Commonwealth shall give the lines and grades of the tunnel, and the lines of the central shaft, and be responsible therefor.

And for the purpose of determining the amount earned by the parties of the first part, from time to time, as the work proceeds, and for no other purpose, the following list of prices shall be taken as a basis of computation.

#### EAST END SECTION.

- 1st. For tunnel enlargement, per cubic yard, *sixteen dollars.*
- 2d. For heading enlargement, per cubic yard, *nine dollars.*
- 3d. For extension of full-size tunnel, per cubic yard, *eleven dollars.*
- 4th. For excavation and construction of central drain, with air and water pipes complete, per linear foot of tunnel, *thirteen dollars.*
- 5th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

#### CENTRAL SECTION.

- 1st. For constructing fire-proof floor over shaft, with self-closing iron hatches, *two thousand dollars.*
- 2d. For repair and completion of timbering to present depth of shaft, per foot in depth, *ten dollars.*
- 3d. For sinking shaft, per foot in depth, *three hundred and ninety-five dollars.*
- 4th. For two ten-inch iron pipes, set in place, per foot in depth of shaft, *six dollars.*
- 5th. For sinking sump below floor of tunnel, per foot in depth, *three hundred and ninety-five dollars.*
- 6th. For excavating full-size section of tunnel, per cubic yard, *fourteen dollars.*
- 7th. For excavation and construction of central drain, with air and water pipes complete, per linear foot of tunnel, *thirteen dollars.*
- 8th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

## WEST END SECTION.

1st. For heading enlargement, per cubic yard, *nine  $\frac{75}{100}$  dollars.*

2d. For extending full-size tunnel east, per cubic yard, *twelve dollars.*

3d. For arching part of tunnel with bricks, per M of bricks laid, *twenty-two dollars.*

4th. For excavating and constructing central drain and laying pipes for supply of air for power and ventilation and water, per linear foot of tunnel, *thirteen dollars.*

5th. For excavating central drain only, per linear foot of tunnel, *four  $\frac{35}{100}$  dollars..*

6th. For constructing central drain west of west shaft, per linear foot, *three dollars.*

7th. For excavating for and constructing fifty linear feet of stone arch and filling over the same, *twenty-three thousand dollars.*

8th. For excavating for and constructing façade to the tunnel and filling around the same, *twenty-six thousand dollars.*

9th. For clearing out and timbering the Haupt tunnel, and maintaining the same, *eight thousand five hundred dollars.*

10th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

And the engineer or engineers of the Commonwealth shall make a monthly measurement and computation of the amount of work done by the parties of the first part, which measurement and computation shall be conclusive upon the parties of the first part; and said engineer or engineers shall each month deliver a certificate in writing, with a statement of the amount in money which has been earned accordingly, to the governor and council.

And whereas it is provided by the statute of 1868, chap. 333, that this contract shall contain satisfactory guarantees for the completion of the whole work herein contracted for, with limitations as to time and cost therein specified; and it is also provided by the statute of 1868, chap. 350, that this contract shall provide for payments by instalments, as the work progresses, in such manner that not less than twenty per centum of each amount due shall be reserved for a final payment on the completion of the same: Now, therefore, it is agreed that no sum whatever shall be demanded by or paid to the parties of the first part, under and in pursuance of this contract, until after they shall have earned, according to the certificates of the engineer or engineers, as above provided, approved by the governor and council, the full sum of five hundred thousand dollars; but



twenty per cent. of each amount so certified by the engineer or engineers shall be reserved for the final payment on the completion of the whole work ; and, for eighty per cent. of each amount so certified, certificates of the Commonwealth, under direction of the governor and council, and in form to be determined by the attorney-general, and approved by the governor and council, shall be issued to the parties of the first part, in sums of twenty thousand dollars each, setting forth the facts, bearing interest at the rate of five per cent. per annum from the time of issuing the same until the time of their redemption, and they shall be paid in Boston from time to time, in the order of their issue, as often as it shall appear by the further certificates of the engineer or engineers, approved by the governor and council, that the parties of the first part have earned so much, that, after reserving twenty per cent. thereof, the Commonwealth will still retain, in all, the full sum of five hundred thousand dollars which is covered by said certificates of the engineer or engineers—it being the intention of the parties hereto that the Commonwealth shall make no payment which will at any time reduce its security from the reserved fund of twenty per cent. and from its guarantee fund aforesaid, below the sum of five hundred thousand dollars. And the Commonwealth shall, until the completion of the contract, reserve twenty per cent. of each amount due for work done, according to the certificates of the engineer or engineers, for a final payment, without any addition for interest, on the completion of the whole work herein contracted for, and its acceptance by the governor and council ; and, subject to the above reservations and provisions, the Commonwealth shall pay to the parties of the first part, at Boston, on or before the fifteenth day of each month following the performance of the work, eighty per cent. of the amount of money earned by them, as ascertained and shown by the certificates of the engineer or engineers ; and upon the final completion of the whole work herein contracted for, and its acceptance by the governor and council, and upon the surrender by the parties of the first part to the Commonwealth of all real and personal property of the Commonwealth which the Commonwealth will then be entitled to receive from them, under the terms of this contract, and in reasonable and proper condition and manner (reasonable use and wearing thereof, and loss or damage by fire or other unavoidable casualty excepted,) and upon the adjustment of all questions growing out of this contract, and the execution and delivery by the parties of the first part of a release of all claims and demands upon the Commonwealth growing out of this contract, then the Commonwealth will pay to the parties of the first part such further sum as

may be necessary to make the full amount of four million five hundred and ninety-four thousand two hundred and sixty-eight dollars; provided that no more than \$3,594,268 shall be paid until the final completion of said work.

In witness whereof the said parties of the first part have hereunto set their hands and seals, and the governor of the Commonwealth and the council  
[STAMP.] have also subscribed these presents and caused the seal of the Commonwealth to be hereunto affixed, on the day and year first above mentioned.

W. SHANLY. [SEAL.]

F. SHANLY, [SEAL.]

By his attorney, W. SHANLY.

[SEAL.]

ALEXANDER H. BULLOCK,  
*Governor.*

WILLIAM CLAFLIN,  
*Lt. Governor.*

THOMAS TALBOT,  
JOHN S. BRAYTON,  
CHAS. ADAMS, JR.,  
HORATIO G. KNIGHT,  
CHAS. ENDICOTT,  
PETER HARVEY,  
R. G. USHER,  
A. K. P. WELCH,  
*Executive Councillors.*



## SCHEDULE.

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### DIMENSIONS OF THE TUNNEL.

In rock, without arch, 24 feet wide in the clear; 20 feet high in the clear.

Where arching is required, 26 feet wide in the clear;  $21\frac{1}{2}$  feet high above the rail when laid down.

A central drain to be constructed as required, with dimensions inside of masonry of not less than 2 feet square.

### THE WORK REQUIRED TO BE DONE AT THE HOOSAC TUNNEL, UPON THE TROY AND GREENFIELD RAILROAD.

#### I.—EAST END OF TUNNEL.

The work already done consists of a tunnel extending into the mountain from the east portal about 2,500 feet, a portion of which has been enlarged to the full height of 20 feet and the width of 24 feet, as proposed, and of a heading about 2,782 feet long, of which 1,700 feet has an average section of about 16 by 8 feet, and the remaining 1,082 feet a section of about 24 by 8 feet, making the distance penetrated from the east portal, 5,282 feet.

#### *The Work to be done is*

1st. Enlargement of tunnel to full size of tunnel section required. Estimated amount, 4,500 cubic yards.

2d. Enlargement of heading to full size of tunnel section required. Estimated amount, 28,000 cubic yards.

3d. Extension of full size section of tunnel westward to meet workings to be brought eastward from central shaft. Estimated length, 5,300 feet, making 85,100 cubic yards.

4th. Excavation below floor of tunnel, and construction of a central drain, as exhibited on the sectional drawing in engineer's office in North Adams, a copy of which is annexed hereto. Estimated length, 5,600 feet.

5th. Provision and laying of the several permanent pipes in trench, as shown in drawing above described, for power, ventilation, and water supply, through a length of tunnel estimated to be 5,600 feet.

6th. Laying one track complete, including the furnishing iron rails, weighing not less than fifty-six pounds to the yard, chairs, spikes, and cross-ties.

The Commonwealth shall permit the use by the contractors, without charge, for the purposes of the work herein specified, of the dam and canal, water-wheels, saw-mill, machine shop, with its shafting, lathes, drills, benches and fixtures, compressors, and other machinery for power and ventilation, now set up and in use, with the buildings connected therewith, together with the pneumatic drills, air and water-pipes, cross-ties, cars, and drill-carriages, which are now in use for the prosecution of the work: stipulating that the contractors shall keep all the same, at all times, in a complete state of repair and efficiency.

The contractors shall hereafter make such repairs, renewals and additions, as shall appear to the officer in charge of the work necessary for durability or security, or for rapid prosecution of the work.

The Commonwealth will also hand over to the contractors all the tools of every description,—iron rails, steel, iron, powder, horses, mules, wagons, harnesses and other materials, now provided, which are available for the work, and the contractors shall take and pay for them at a valuation to be agreed upon by the parties to this contract, or in case of their disagreement or failure to act, the valuation shall be made by two competent persons, one of whom shall be selected by the governor and council, and the other by the contractors, the arbitrators to choose an umpire in case of disagreement, said valuation to be fixed upon before the commencement of the work.

The Commonwealth will lease to the contractors, at a rent to be determined in the same way, the blacksmith's and other shops, with their fixtures for repairs of tools, cars, etc.

Such further buildings, machinery and material as may be needed for the work shall be provided by the contractors.

The material removed from the tunnel at both ends thereof, will be deposited wherever the Commonwealth, by its officers in charge of the work, shall direct, it being understood that in case the contractors shall be required to deposit the same in embankment or spoil bank on the east of the Deerfield River, they shall have the privilege of using the bridge to be erected by the Commonwealth under such reasonable restrictions as may be required; and the



contractors shall not be required to haul the same more than 3,000 feet from either end of the tunnel.

The contractors shall from and after the commencement of work under this contract employ the necessary force of miners, laborers, &c., and shall maintain average rates of advance on each of the several sections, described as follows:—

1st. On the tunnel enlargement, 75 feet per month.

2d. On the heading enlargement, 75 feet per month.

3d. Extension of full-size tunnel, 125 feet per month.

4th. Excavation and construction of central drain, and laying pipes through the tunnel, 150 feet per month, or not more than 500 feet behind the advanced heading.

The work of each separate section described shall be commenced at the west end of work completed by the State, and thence carried with a completed advance westward, reserving always to the contractors the privilege of working two or more breasts on each one of the sections described, in order to make up the aggregate rate of progress required in each.

Temporary use of timber for covering central drain, as heretofore found convenient, will still be permitted, but permanent stone coverings must be provided and put in place, in advance of any allowance for track-laying.

Estimates will be made only of quantities within the exterior lines prescribed for the tunnel.

Any material detached by blasting or otherwise outside of said lines must be removed by the contractors without charge.

## II.—CENTRAL SECTION.

The work already done consists in the sinking of 583 feet of the shaft, which is intended to have a total depth of about 1,030 feet to floor of tunnel, with such additional depth as may be deemed necessary for a sump.

The shaft is of an elliptical form, 27 feet in diameter on line of tunnel by 15 feet transverse diameter, making an area of about 318 square feet, or  $11\frac{3}{4}$  cubic yards per foot of depth.

### *Work to be done is*

1st. To construct over the shaft a fire-proof floor, with self-closing iron hatches.

2d. To repair and complete timbering and finish excavation to present depth of shaft.

3d. To sink the shaft to floor of tunnel.

4th. To set up two 10-inch iron pipes, for purposes of power and ventilation.

5th. To sink the sump below floor of tunnel.

6th. To excavate a tunnel east and west therefrom until it shall meet workings respectively from east end and west shaft.

7th. To construct the central drain, with air and water pipes complete, as shown on drawings exhibited at engineer's office, a copy of which is annexed hereto.

8th. Laying one track complete, including the furnishing iron rails, weighing not less than fifty-six pounds to the yard, chairs, spikes and cross-ties.

The contractors shall complete the shaft to the floor of the tunnel by the first day of May, 1870.

They shall, before June 1, 1870, furnish and set in place the additional machinery, compressors, &c., requisite to maintain in the power-pipe a constant pressure of 50 pounds per square inch while supplying in each heading the continuous working of 8 pneumatic drills, and also provide requisite air-pumps of power sufficient to furnish through the ventilation-pipe the proper air-supply for the ventilation of each of the headings.

They shall employ suitable force, and shall maintain, after June 1, 1870, an average rate of monthly progress of tunnel excavated to full size, east and west, of not less than 80 feet in each direction.

All excavations from shaft or headings shall be deposited where directed by the engineer.

Price paid per linear foot of depth of shaft will include cost of sinking the shaft and removal of material to spoil banks as shall be required, and of such additional timbering, framework, &c., as may be necessary for arrangement of pumps, hoisting apparatus, and other machinery required.

The contractors will have the privilege of using without charge all the machinery designed for purposes of hoisting, pumping, ventilation, &c., already erected by the Commonwealth, and also the buildings over the shaft, the machine-shop and machinery, water-pipes, drains, &c.

They shall constantly maintain the same in good condition by repairs and renewals, and return the same in good order at the expiration of their contract.

They will supply at their own expense the additional hoisting, pumping, ventilating and drilling machinery which may be required, excavate the spaces for, and furnish tanks, and also place ladders and other constructions and devices for escape and safety as required by the officers of the Commonwealth in charge of the work.



They may occupy and use the saw-mill, and blacksmith's and other shops erected by the Commonwealth, except such as may be reserved by the officers of the Commonwealth in charge, shall keep the same constantly in repair, and pay therefor a rent, to be established in same manner as is provided in the case of rents at the east end.

All horses, mules, wagons, tools, steel, iron and iron rails, powder, lumber and other materials provided by the Commonwealth, which are available for their work, shall be taken by them, at a valuation to be fixed upon before they shall commence the work, and to be ascertained, in case the parties do not agree, by arbitrators, chosen in same manner as provided for at east end.

### III.—WEST END SECTION.

The work already done consists of a shaft 318 feet deep, having a section of 8 by 14 feet, from which headings have been extended about 1,609 feet east and westward to west end, and of a supplementary shaft 264 feet distant to the west therefrom and 277 feet deep, used only for purposes of pumping, and of an auxiliary shaft 685 feet farther to the west and 215 feet deep, through which the material of west heading may be hoisted until an opening can be made to west end.

From the present western end of the tunnel, a distance of about 860 feet has been completed by B. N. Farren, contractor, who has existing contracts, upon which he is now engaged and under which he is to complete the tunnel to a point 931 feet east of west end on or before the 1st day of June, 1869.

#### *The work to be done under these Specifications consists in*

1st. Enlargements of the headings already driven, and of the adit to the full-size section of the tunnel. Estimated amount—52,800 cubic yards.

2d. Extension of a full-size tunnel eastward until it shall meet the workings in opposite direction from the central shaft.

3d. Arching part of the tunnel with sound and hard-burned bricks. Amount of bricks to be laid not to exceed 4,500,000.

4th. Construction of the central drain, and in furnishing and laying the air and water pipes therein.

5th. Excavating for and constructing fifty linear feet of stone arch additional, and joined on to the present west end of brick arch, on such plan as may be furnished by the engineer or engineers, supported on foundations to be approved by the engineer or engineers, and properly filling over the same.

6th. Excavating for and constructing of granite a suitable façade to the tunnel on such plan as may be furnished by the engineer or engineers, to contain about 800 cubic yards, and properly filling around the same.

7th. Clearing out and securely timbering the Haupt tunnel, so called, and maintaining the same until the completion of this contract.

The construction of the stone arch and the façade, being numbers 5 and 6 of the specifications for this section, is not to be commenced until the same is ordered by the governor and council.

8th. Furnishing and laying one track, including rails, chairs, spikes and cross-ties complete, according to specifications for track provided under head of General Stipulations.

The contractors shall employ suitable force, and shall maintain, after May 1st, 1869, an average rate eastward of monthly progress of tunnel excavated to full size of not less than 100 feet.

The contractors will have the privilege of using without charge all the machinery designed for purposes of hoisting, pumping, power and ventilation, &c., already erected by the Commonwealth, and also the buildings over the shaft, machine-shop, with the shafting, lathes, drills, benches and fixtures and machinery, cars, pneumatic-drills and drill-carriages, water-pipes, drains, &c., stipulating that they shall keep the same at all times in a complete state of repair and efficiency.

The contractors hereafter shall make such repairs, renewals and additions as shall appear to the officers in charge of the work necessary for durability or security, or for rapid prosecution of the work.

The Commonwealth will also hand over to the contractors all the tools of every description—steel, iron and iron rails, powder, horses, mules, wagons, harnesses, and other materials, now provided, available for work; and they shall take and pay for them at a valuation to be fixed upon before they shall commence the work, and to be ascertained, in case the parties do not agree, by arbitrators, chosen in the same manner as provided for at east end.

The Commonwealth will lease to the contractors, at a rent to be determined in the same way, the blacksmith's and other shops, with their fixtures for repairs of tools, cars, etc.

Such further buildings, machinery and material as may be needed for the work shall be provided by the contractors.

Estimates will be based upon quantity of material which lies within the line of section prescribed by the engineer or engineers, and any material falling from outside of these lines, whether detached by blasts or falls, must be removed by the contractors without charge.



It being understood that where the engineer or engineers shall become satisfied that outside timber support is needed during the construction of the arch, he shall prescribe lines of section one foot outside of brick arch, as an allowance of space for timbering.

Dimensions and thickness of the successive portions of the brick arch will be prescribed by the officers of the Commonwealth in charge of the work as the same progresses.

Price per cubic yard for excavation of tunnel shall include all cost of temporary supports, pumping, drainage, power, ventilation and all material and labor and appliances requisite therefor, in addition to those which have already been provided,—and also cost of hauling and depositing the excavated material as the engineer shall direct.

Price per M for bricks laid in arch shall include cost of timber for support, framing centres, labor, cement, sand, and all materials and labor requisite for making the arch complete.

Quality of bricks, mode of mixing and using mortar, and quality and proportions of cement and sand shall be such as shall be prescribed and approved by the officers in charge of the work.

The contractors shall promptly remove and properly rebuild any work found bad or imperfect, or not in conformity with lines, grades and plans furnished.

All holes or vacancies outside of brick arch must be closely packed with stone of suitable size, by the contractors, without charge therefor.

All suitable bricks made at the State Brick Yard, during the present year, and not required by the Commonwealth or for Farren's contract, shall be supplied to the contractors and taken by them at \$9 per M, the same to be taken out of the amount due upon current monthly estimates.

The bricks are to be delivered at or near the yard, counted in piles, and thenceforward all loss or breakage in transportation or otherwise to be borne by the contractors.

#### IV.—GENERAL STIPULATIONS.

Applicable to each of the foregoing divisions of the work:—

The dwellings and store-houses of all kinds erected at the east end, central shaft, and west end, except such as may be already disposed of or may be reserved by the officers of the Commonwealth in charge of the work, to be rented of the Commonwealth by the contractors, at the same rents as heretofore established, and the amount retained out of their monthly payments.

Measurements definitely establishing the present condition of the

tunnel and other work shall be made before the contractors commence upon the same.

Monthly estimates to be made by the engineer or engineers of the amount and value of work done during the month preceding; and at the completion of the work a final estimate shall be made by the engineer or engineers of the whole amount appearing to be due under this contract.

In case it shall appear at any time during the progress of the work that machinery provided at any point is not longer necessary there for the purposes of the work, then it shall be in the discretion of the officers in charge of the work to remove the same, if it be of the property provided by the State.

The work to be done under the direction and to the entire satisfaction of the governor and council as indicated through the officers in charge of the work.

The contractors shall use their best efforts to keep intoxicating liquors from their employés, and to promote orderly conduct among them; and shall, when required by the engineer, discharge any men who shall be careless, negligent or incompetent, or guilty of conduct prejudicial to good order.

An employé once discharged for misconduct shall not be again employed upon the work without the consent of the engineer or engineers.

The prices heretofore named for rates of progress provide for all constructions, machinery, material and labor, &c., and for the cost of all accessory works requisite for the completion of the work described in these specifications, all of which shall be supplied by the contractors.

As a more rapid progress of the work is required than drilling by hand labor would accomplish, upon each of the advance headings, between the east portal and west shaft, the contractors will be required to use the pneumatic drills, working continuously not less than eight drills to a heading of eight feet height, with no less than fifty pounds air-pressure, but with the liberty to employ the form of machine now in use in the tunnel or any other drill of equal efficiency which they may prefer, and provide at their own expense.

The contractors shall keep the completed portions of their work clear of all obstructions; and shall, whenever required by the engineer or engineers, remove from the tunnel and shaft all machinery, fixtures, and material not needed for their work.

The track to be laid shall in all respects conform with the specifications in Farren's contract for the track of the Troy and Greenfield Railroad east of the tunnel, and shall not be laid or paid until the tunnel is completed.



The parties of the first part shall, at their own cost and charge, cause the buildings and property of the Commonwealth which is allowed to the contractors without charge, to be insured against loss or damage by fire, in such reasonable amounts as shall be approved by the governor and council. The policies to be payable to the Commonwealth in case of loss. All moneys collected on such policies to be applied to the restoration of such property. But in no event is the Commonwealth to be further chargeable for such restoration.

It is understood and agreed, that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule, nor shall the specific details of work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part now under contract to B. N. Farren, to be performed under this contract, nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract.

The foregoing schedule, contained in pages 6 to 12, is the schedule referred to in the body of the contract for the completion of the Hoosac Tunnel, executed this day, Dec. 24, 1868.

ALEXANDER H. BULLOCK, *Governor*.  
W. SHANLY.

COMMONWEALTH OF MASSACHUSETTS.

SECRETARY'S DEPARTMENT, BOSTON, December 24, 1868.

I hereby certify that the above is a true copy.

OLIVER WARNER, *Secretary*.





EVIDENCE AND ARGUMENTS

ON THE

PETITION

OF

WALTER AND FRANCIS SHANLY,

BEFORE THE

COMMITTEE ON THE HOOSAC TUNNEL AND  
TROY & GREENFIELD RAILROAD.

---

BOSTON:

WRIGHT & POTTER, STATE PRINTERS,  
79 MILK STREET (CORNER OF FEDERAL).

1874.





# HEARING.

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THURSDAY, February 19, 1874.

The Committee met at 10½ o'clock.

MR. TRAIN.—Mr. Chairman, I do not know that I have any particular wish about the mode in which this hearing should proceed, only I should like to know how it will proceed. If Mr. Allen goes on this morning putting in additional evidence, I suppose I have a right to follow him.

THE CHAIRMAN.—This is a hearing, Mr. Train, on a memorial presented since the filing of the original petition.

MR. TRAIN.—I did not so understand.

THE CHAIRMAN.—We have the memorial before us.

MR. TRAIN.—I have misunderstood your letter then, Mr. Chairman.

THE CHAIRMAN.—Well, I have understood that the petition presented before is formally withdrawn, and I had supposed that there would be no further hearing upon it. At any rate, this hearing is not for the purpose of continuing that hearing, but for the purpose of hearing what may be said with reference to this new memorial. Perhaps, Mr. Allen, you will read it, and then proceed in any way that you see fit.

## OPENING ARGUMENT OF MR. ALLEN.

Mr. Allen then read the memorial, as follows:—

*To the Senate and Representatives of the Commonwealth of Massachusetts,  
in General Court assembled.*

The undersigned, Walter and Francis Shanly, contractors for the Hoo-sac Tunnel, respectfully represent that the work is now rapidly advancing towards completion; that of the amount for which they undertook the contract (\$4,594,268), less than \$800,000 now remain to be earned, and that over and above that amount a sum of \$350,000 is, under Resolves enacted by the legislature last year, withheld from them as guaranty for the due fulfilment by them of their engagements towards the Common-

wealth, of which sum \$200,000 are represented by certificates held by your petitioners, and payable on the full completion of the work.

The financial exigencies of your petitioners, the contractors, compel them to apply to your honorable court to afford them relief, by ordering that the amount of the aforesaid certificates—\$200,000—be, upon their surrendering the same, paid to them in cash, as soon as the necessary legislation can be had, still leaving in the state treasury \$150,000 as security for the proper completion of their contract, over and above the balance yet to be earned thereupon. All of which is respectfully submitted.

(Signed) W. SHANLY,  
F. SHANLY,

By his attorney, W. SHANLY.

NORTH ADAMS, January, 1874.

*To the Honorable the Senate and House of Representatives, in General Court assembled*

The undersigned, Walter Shanly and Francis Shanly, respectfully represent that by the terms of their contract for the construction of the Hoosac Tunnel they undertook and promised to arch a part of the west end section of the Tunnel with bricks, it being specified that the amount of bricks to be laid there should not exceed 4,500,000; that their contract nowhere provides for or contemplates arching any other portion of the Tunnel with bricks; that at the time said contract was made, and for many years before, it was and had been assumed by the Commonwealth and its officers, as appears by a series of public documents of the Commonwealth, that no brick arching would be necessary, except for a comparatively short distance at the west end; that the formal "specifications of the work required to be done at the Hoosac Tunnel," prepared by the Commonwealth, and upon which the contract of the undersigned was founded, show distinctly that no other brick arching was contemplated; that, as the undersigned are advised and believe, their said contract, in its true legal construction, does not require them to arch any portion of the Tunnel except in the west end section, and there to an amount not exceeding 4,500,000 bricks; that, in compliance with the direction of the engineer of the Commonwealth, they completed, in August, 1872, an amount of brick arching in the west end section which was then considered by him as sufficient for the protection of the Tunnel in that section, and the finishing of the same was made the occasion of a special ceremony, the engineer putting in the last brick with his own hands; that, upon the request of said engineer, the undersigned then surrendered the Commonwealth's brick-yard to the Commonwealth, it being understood that no further arching would be required under their contract; that the number of bricks laid did not at that time amount to 4,500,000; that no further directions to lay any brick arch were given until July, 1873, when the undersigned received instructions from the engineer to extend the arch in the west end section 344 feet further, and also to build 40 feet of similar arch in the east section; that these two pieces of work were calculated accurately to absorb what still remained unused of the

contract limit of 4,500,000 bricks; that they promptly procured the bricks for the said 344 feet in the west end section and are prepared to do the work, but they decline to recognize that they were bound by their contract to do any arching outside of the west end section; that recently the undersigned have received orders for the first time, to arch a distance of about 1,800 feet in length in the central section of the Tunnel, and to make an enlarged excavation of rock to allow such arching, involving an expense of not less than \$300,000; that it has been apparent for two years and over that more or less of such arching would be required in order to secure perfect safety in the continued use of the Tunnel, but the engineer has never given notice to the undersigned that they would be expected to do it till recently; that it is now impossible to obtain the bricks and finish this work before the first of September, 1874, the date contemplated by the contract to which it might be necessary to extend the completion of the work; that the undersigned believe their contract does not require them to do it, nor have they pecuniary means to enable them to do it; that the amount heretofore received by them from the State is several hundred thousand dollars less than their disbursements already made in performing their contract, and upon receiving payment in full from the State at the completion of the work which they consider themselves bound to perform, they will still be heavy losers under their contract; that they are, nevertheless, ready and willing, and have a full intention of doing all that is required of them, according to their understanding of the true construction of their contract, and have no doubt of being able to complete the same before said first day of September, 1874.

That difficulties have arisen from time to time in the prosecution of the work, which were unexpected at the date of the contract, and which made it impossible to preserve at all times the prescribed rates of progress in certain portions of the work, but they have largely made up for the deficiencies so caused by exceeding the prescribed rates whenever possible; that some of these unexpected difficulties were the following: the great freshet of October, 1869, washing away the Troy and Greenfield Railroad, and preventing the running of trains for about nine months, and also causing damage at the west end workings; the failure of the Deerfield River dam to supply continuous power, rendering the erection of steam works necessary; the change in the geological formation of the mountain, west of the central shaft, and the great influx of water, rendering new and expensive machinery for hoisting the water necessary, and causing great delay; defects in the old foundation, prepared by the State at the central shaft, which proved insufficient to support the new hoisting apparatus, and had to be newly constructed, requiring about two months' time; the final impossibility, from the great influx of water, of driving the work west of the central shaft until an opening was made by which the water could be taken out through the east end of the Tunnel. In consequence of these and other unexpected difficulties, the expenses of constructing the Tunnel have been increased several hundred thousand dollars, and considerable delays unavoidably incurred. Nevertheless, the undersigned have pressed forward the work



with energy, eliciting from the state engineer, in his report for 1872 (Senate document of 1873, No. 201) the comment, that "with the single exception of progress westward from the central shaft \* \* \* \* the results obtained have satisfied the most sanguine anticipations"; and that "the extraordinary progress is due largely to the extraordinary exertions made."

Wherefore, having nothing now to gain under their contract except the reputation of having successfully performed this great public work, they pray (in addition to the prayer of their former petition) that an Act or Resolve may be passed, declaring that, according to the true construction of their contract, the undersigned are not bound to do any brick arching of the Tunnel, except in the west end section, and in that section to an amount not exceeding 4,500,000 bricks, and that, upon doing the same, and in other respects complying with the terms of their contract on or before the 1st of September, 1874, or such other seasonable period as may be fixed by the governor and council, they shall be held to have fulfilled and performed the same on their parts.

W. & F. SHANLY,

By W. SHANLY.

BOSTON, 7th February, 1874.

The CHAIRMAN.—I understand from the reading of this, Mr. Allen, that it is supplementary to the petition which has been already filed, and that you ask for this relief in addition to that which you prayed for in the former petition.

Mr. ALLEN. Yes, sir.

The CHAIRMAN.—So that the whole thing may be considered together, and we can proceed with the hearing in such order as you choose.

Mr. ALLEN.—A good deal of testimony which we would like to lay before the Committee is contained in documents referred to in the petition, and if the Committee assent to that method of doing it, I would like to make a statement which shall include a reference to these documents, and put them in, in order, with such opening observations as may seem adapted to the case. I would like, in that manner, to lay what seems to me to be the merits of the case before the Committee, and supplement it by calling witnesses.

The CHAIRMAN.—Proceed in your own way.

Mr. ALLEN.—In the first place, taking the suggestions and the representations which are made in the petition somewhat in their order, I desire to say to the Committee that it has always been assumed by the officers and representatives of the State, for many years prior to entering into this contract, that, in the construction of this tunnel, there would not be a necessity for any brick arching except at the west end. Having done that, I will pass to other points.

At the legislative hearing in 1853, a report of which is contained in the first volume of the Hoosac Tunnel documents in the state library, A. T. Edwards testified——

Mr. TRAIN.—On what page?

Mr. ALLEN.—These are pamphlets bound together, and there is an index here to them, and the page to which I refer is page 15 of the pamphlet. There is no continuous series of pages throughout the volume.

The CHAIRMAN.—These documents, to which you are now making reference, are contained in what you call the Hoosac Tunnel documents, Vol. I.?

Mr. ALLEN.—Yes, sir. Mr. Edwards testifies in that hearing, that, in 1851, President Hitchcock, of Amherst College, had given his opinion of the character of the mountain, and that Professor Emmons, of Williams College, the state geologist of New York, had been consulted by him (Mr. Edwards), and agreed in President Hitchcock's opinion. In the report of the Committee of the legislature made upon that hearing, and found in the House documents of 1853, No. 125, is the following statement:—

“Several of the oldest geologists of the country, including the state geologists of Massachusetts, New York and Virginia, have examined the rock and pronounced it mica slate, standing in almost vertical strata, and none of the geologists express a doubt that the same material will be met by the tunnel through its whole extent.”

That is found on page 80 of that report; and, in estimating the cost of completing the tunnel, it was assumed that no arching would be required; that is shown on p. 83. In 1854, President Hitchcock appeared again before the legislative committee, and Vol. II. of the Hoosac Tunnel documents has a report of the hearing in full. It is the first document contained in this second volume of the Hoosac Tunnel documents, and this testimony of President Hitchcock, of which I will read some portion to you, has been quoted and adopted and sanctioned, as I will show to you, by numerous officers of the State, to such an extent, and in such language, that it may fairly be said to have been adopted by the State as testimony adduced and published by its authority; and it is the foundation of the opinion which has prevailed in respect to the character of that mountain; or rather, it is the most authoritative exposition of it. His testimony is very long, and I will not read the whole of it, but only certain passages.

“There is scarce anything in the mountain but this mica slate, occasionally mixed up, however, with a little quartz of an imperfect kind, which does not differ materially from the mica slate in hardness. The

whole mountain is made up in the same way. There is no granite or trap intruded in the form of veins or dikes. \* \* \* It is the same rock all the way till you get near the foot on the west side. I have no doubt at all, that the whole mountain is composed throughout of this mica slate, as well as on the surface, and probably it is the same rock thousands of feet lower than the Connecticut River. I will give my reasons for this opinion. It now seems to be generally admitted in relation to the slate formation, though the whole of the Green Mountain range, that it was not lifted up by granite or any of the igneous rocks, pushing upward from underneath, but crowded together from the sides or edges. \* \* \*

"I do not think there will be any masonry or arching required. For instance, if the boring machine should be found to operate well, and the Tunnel should be bored through the mountain, I do not believe that it would require any more masonry for its support than would be necessary for a good sound stick of timber with an auger-hole bored through it. A little masonry may of course be required at the ends, but I have so much confidence in this opinion, that I should not be afraid to engage to put in all the masonry that will be necessary after you get beyond the surface, for a very few thousand dollars. If there is any confidence to be placed in the principles of geology, then we may rely upon the rock's proving to be the same throughout the mountain, without cavities. It would be a thing unheard of in geology otherwise. \* \* \*

"Water will undoubtedly be found near the surface, and elsewhere to some extent, but I have an impression, or rather an opinion, that this Tunnel will be found to go below where the water percolates, unless the layers are found to be more broken than I suppose they are. \* \* \* I have an impression that this Tunnel will be found dry, after penetrating a considerable distance from the surface. \* \* \*

"In reply to questions by Mr. Wiggin, representative from Boston, he said, if the rock of the Tunnel should be found to differ from what he had supposed, it would be an exception to the general rules of the science. Of course, he had not been in the interior of the mountain to examine the rock, but there were no reasons why geologists might not be able to judge; and he was certain that no veins of granite, trap, porphyry, &c., exist in the mountain." (Pages 8-11.)

This testimony of President Hitchcock has since been quoted and approved by officers of the State, as I have said before, to such an extent, and in such language, that it may fairly be said to have been adopted by the State as testimony adduced and published by its authority. You know that a commission was appointed by Governor Andrew, consisting of John W. Brooks, S. M. Felton, and Alex. Holmes, to examine the question in regard to the construction of the Hoosac Tunnel and the feasibility of it; and they made their report, which is so often referred to, in the year 1863, going over the whole subject, and they used this language, after quoting quite at length President Hitchcock's testimony, substantially as I have quoted it to you:—



"The shaft which has been driven down to the line of the Tunnel at a point 3,008 feet easterly from the western portal, shows rock of the same character as that at the east end. This fact and the surface examinations across the mountain, with President Hitchcock's opinions as quoted, are strong evidence of the general uniformity of the rock through the mountain."

This was the commission appointed in behalf of the State by Governor Andrew, and their report is contained in Senate document No. 93, of 1863, and the extract which I have read will be found on page 40 of their report. Again they say, on page 54 :—

"Our estimate [of cost] will be based upon President Hitchcock's opinion, the highest attainable authority, that the quantity of water to be met with, except in the secondary formation at the west end, will not be so large as to be seriously troublesome."

The commissioners then make an estimate, which includes only 1,350 feet of arching at the west end, on page 55, and say :—

"Exposed as such works are to the development of hidden difficulties, we present this estimate with a due sense of the uncertainty which pervades it. We can only say that unless President Hitchcock's views of the interior character of the mountain are widely astray, we think it is sufficient."

That is on page 56. Accompanying this report were reports by the engineers, and Mr. Latrobe in his report says :—

"I notice that the eminent geologist, President Hitchcock, regards the Hoosac range as not having been lifted up by granite or any of the igneous rocks pushing upwards from underneath, but crowded together from the sides or edges so as to cause a folding together of the strata. Higher authority could not be adduced upon such a subject. We must assume it to be correct until disproved by the future development of facts. I am disposed, therefore, in estimating time and cost, to treat the rock still to be perforated by the tunnel and shafts as resembling that already excavated."

That is on page 133. Mr. Laurie estimates that about 1,200 feet at the west end will require arching, (page 189). Governor Andrew, in his special message presenting this report, says that the commissioners have discharged their duties "in a manner at once elaborate, comprehensive, instructive and convincing"; and he adopts their estimates of cost. That will be found in the Blue Book of 1863, pages 640 and 641. The joint committee of 1868 on the Troy & Greenfield Railroad, in making their report, which

they presented in the early part of 1869, and which will be found in the Senate documents of 1869, No. 61, say as follows:—

“Beyond the shaft [i. e. E. of the west shaft] *all the rock is self-sustaining and will be found so through the mountain.* As Professor Hitchcock has said, in another connection, it would be a thing unheard of in geology were it otherwise.” (Page 12.)

That part of the quotation, “all the rock is self-sustaining,” is put into italics by the committee themselves, so as to call attention to it. Again they say:—

“The proofs derived from actual inspection at the east end, central shaft and west end are morally irresistible in forcing the conclusion that *progress at all points has to depend hereafter solely on the greater or less hardness of the material, and the greater or less efficiency of the means that may be devised for breaking it up.*”

The last part of that quotation, which will be found on page 13, is also put into italics by the committee. Thus it appears that this testimony of President Hitchcock has been adopted by the governor of the State, by the joint committee of the legislature, by the engineers of the State, and by the commissioners,—four state authorities. In 1866, Mr. Latrobe presented a report to the joint committee of the legislature (House Doc. of 1867, No. 30), estimating the time required to complete the Tunnel, and after repeatedly referring to an arch at the west end, but never at any other part of the Tunnel, he says, in estimating the probable cost, “the length assumed to require arching being 2,004 feet at the west end, there will remain 22,859 feet, which, at eighteen cubic yards per foot, give 411,444 cubic yards.” “That is his estimate, and the length which he assumes to require arching at the west end is 2,004 feet, which, he says, at eighteen cubic yards per foot, gives 411,444 cubic yards, it being then proposed to have the Tunnel of a somewhat different size from that which was finally adopted.

The report of the committee at the same time also recognizes that no masonry was expected elsewhere. That is shown on page 7. Governor Bullock, in his message to the legislature in 1867, referring to this report of Mr. Latrobe, says: “You will find the amount of excavation yet to be made definitely expressed by cubic yards.” That appears in the Blue Book of that year, page 818. Here was another recognition by another governor of the Commonwealth, that no arching was expected, except at the west end, by the report of the engineer, which said, so much remains to be done, which, at eighteen cubic yards per foot, gives 411,444 cubic yards. The

joint legislative committee of 1867 (Senate Doc. of 1868, No. 102), say, after referring to the Farren contract, with which, I suppose, you are all familiar, and know that that was the contract, the east end of which left off at the place where the west end of Mr. Shanly's work begins: "When the work under this last contract is completed, we believe the west heading will be advanced beyond the difficulties which are to be surmounted by brick-work." That is page 8. Farren's contract was completed early in 1869, and that expression of the committee shows that they expected that, by that time, the heading would have reached through all the portion that required to be arched.

So that, it appears, as it seems to me, conclusively, from this continuous series of public documents,—statements of officers of the State, not of interested parties, and the testimony of President Hitchcock, which has been adopted and sanctioned and published as reliable by officers of the State,—it appears, I say, by all of these proofs contained in these documents, and, therefore, it is not open to question, that it has always been supposed, and put forward by officers of the State, down to the time that the specifications for this contract were issued, that it was not expected that any arching would be required, except at the west end, and there only for a short distance,—the highest estimate, I believe, being that of Mr. Latrobe, of 2,004 feet.

We have now come down to the time when the Commonwealth put out its specifications calling upon contractors to send in their bids for doing this work of completing the Hoosac Tunnel. This was done in the summer of 1868, and I have in my hand a copy of the specifications which Mr. Shanly obtained at that time, showing that, when the Commonwealth specified the work which was to be done, it did not enter into the mind of the engineer that any arching would be necessary, except at the west end. It specified the items of work which were to be done.

The CHAIRMAN.—Is that an advertisement for bids for the work, or what is the character of that document?

Mr. ALLEN.—It starts with specifications of the work required to be done at the Hoosac Tunnel on the Troy & Greenfield Railroad.

The CHAIRMAN.—My inquiry is whether this is an advertisement soliciting bids for the work, and specifying the work to be done, or what is the character of the document?

Mr. ALLEN.—Advertisements were placed in the papers stating that this work was to be done, and inviting contractors to call for the specifications, and when they called these specifications were put into their hands. The specifications were printed in considerable numbers, commencing with the words, "Specifications of the work



required to be done at the Hoosac Tunnel upon the Troy & Greenfield Railroad." It starts off with the east end of the Tunnel, and says :—

"The work already done consists of a Tunnel extending into the mountain from the east portal about 2,500 feet, a portion of which has been enlarged to the full height of 20 feet as proposed, and of a heading 2,650 feet long, of which 1,750 feet is an average section of 16 by 7 feet, and the remaining 900 feet a section of 24 by 8, making the distance penetrated from the east portal, 5,150 feet. The work to be done after August 1st, 1868, is"—

and then it gives six items in detail of the work to be done, as follows :—

"*First*, the enlargement of Tunnel to full size of Tunnel-section required; estimated amount 5,100 cubic yards. *Second*, enlargement of heading to full size of Tunnel-section required; estimated amount 27,400 cubic yards. *Third*, extension of full size section of Tunnel westward to meet working to be brought eastward from central shaft; estimated length 5,300 feet, making 86,900 cubic yards. *Fourth*, excavation below floor of Tunnel, and construction of a central drain as exhibited on the sectional drawing in engineer's office in North Adams; estimated length 5,800 feet. *Fifth*, provision and laying of the several permanent pipes in trench, as shown in drawing above described, for power, ventilation and water-supply through a length of Tunnel estimated to be 6,400 feet. *Sixth*, laying down track complete, including the furnishing of iron rails, chairs, spikes and cross-ties; estimated to be two miles."

Then it goes on giving various provisions, and then it comes to the central shaft, describes the work which has been done there, and the particulars of the work to be done afterwards; then it goes to the west shaft and west end workings, and describes the work that has been done there and the work which has to be done afterwards. Then it gives some general stipulations, and finally makes some provisions for the manner of payment.

There is in these specifications no mention of any brick-work to be done anywhere, except in the west section. One of the specifications there is: "Arching part of the Tunnel with sound and hard-burned bricks; estimated amount of bricks, four million." In the specifications of the eastern section the following language is used:

"As the rock is sufficiently hard to prevent apprehensions from falls and slides, estimates will be made only of quantities within the exterior line prescribed for the Tunnel."

They state to the contractor, in direct terms, that the rock is sufficiently hard to prevent apprehension from falls or slides, and

therefore that the estimates of his work will be confined to what comes within the line prescribed for the Tunnel. Then, having gone on and described the work that was to be done in completing the Tunnel, they call for bids in the following language: "*For each of the several items of work*, as hereafter named, the prices shall be as follows." They do not allow the contractor to offer to do the work of constructing this Tunnel for a lump sum, but they require him to fix the prices in detail for which he will do the various items of work which are specified in these specifications. They say on the 7th page, under the 5th heading, "Prices to be paid," and then recapitulate these items, which have been specified as composing the work to be done, including the estimate for arching a part of the Tunnel with bricks, per thousand bricks laid. The way in which these bids were to be made was, "for so many cubic yards of Tunnel enlargement," so much "for heading enlargement, per cubic yard," "for extension of full-size Tunnel, per cubic yard," "for excavation and construction of central drain, with air and water-pipes complete, per lineal foot of Tunnel," "for furnishing and laying down track complete, per mile," and so on. And then, when it comes to the west shaft, they call on the contractor to make a bid for arching part of the Tunnel, per thousand of bricks laid.

Now, when Mr. Shanly came to make his bid, he made it in this way. I hold in my hand an exact copy of the bid which he made, and I find that it says: "For Tunnel enlargement, per cubic yard, \$16," "for heading enlargement, per cubic yard, \$9." I will hand the document to the Chairman.

The CHAIRMAN.—Is this the original bid?

Mr. ALLEN.—This is a precise copy of the bid—the original is undoubtedly in the office of the executive—and the other bids were made in the same way, with the exception of Gen. Haupt's, which was \$5,000,000 in a round sum, instead of by items, as called for. The total sum named in the contract of the Messrs. Shanly was arrived at by Mr. Shanly upon a computation of the aggregate amount of the several items named in his bid. Now, Mr. Shanly's bid was accepted.

The CHAIRMAN.—Do I understand you to say that a computation of these various items in this paper will make the sum total named in Mr. Shanly's contract?

Mr. ALLEN.—Yes, sir.

The CHAIRMAN.—Exactly?

Mr. ALLEN.—Yes, sir; I am coming to that presently. Mr. Shanly's bid was accepted, I say. It was found that there were two bids lower, but they could not comply with the conditions, and Mr. Shanly had come to an understanding with the executive—as to

which I shall put him on the stand to testify—and nothing remained but to put his contract into form. He was asked, and consented, to make the price a lump sum, taking Frost's measurements as a basis. In order to ascertain the amount, he and Mr. Frost had a long session together. The various items in his bid were computed on the basis of Mr. Frost's estimates. There was no time then, as it was far advanced in the season,—for the contract, you may remember, was executed on the 24th December, 1868, just before the expiration of Gov. Bullock's term of office,—there was no time for Mr. Shanly to go up to the Tunnel and make measurements for himself; and when you consider that in order to ascertain the amount of cubic yards of rock which had already been taken out, it would be necessary to take a section of the Hoosac Tunnel at short distances, say of twenty-five feet, so as to see how much remained to be done, you will see at once that to make those calculations would have been the work of weeks, if not of months, and accordingly Mr. Shanly consented to take the estimate of Mr. Frost, the engineer of the State, as to the measurements of the Tunnel which had already been done, Mr. Frost saying to him that these measurements were accurate, and accordingly he thus arrived at the contract sum which is named to be paid for this work. He went over, with Mr. Frost, in detail, and multiplied the number of cubic yards by the price per cubic yard, as stated in these bids, and the amount of the various items makes up the amount of the contract price for the work, \$4,594,268, and that is the exact amount that the simple addition of these items comes to. I have here Mr. Shanly to testify to it; I have got all the figures which he made at the time on Mr. Frost's statement of the amount of work then remaining to be done.

Now, if after he had been called to put this contract into this form, and to have a lump sum inserted, instead of a price by items, such as he was required to fix in his bid, \$100,000 or any other sum had been added for contingencies not contemplated at the time, there would, I conceive, be a very different case from the present. It might then well be said that he took some risk; but when he was required to make his bid by items, under specifications which assured him that the rock was hard enough to prevent apprehension from falls and slides; and when you are satisfied, as you will be, that in putting that contract into form, not a dollar was added to the aggregate of the single items, I think you will perceive that if the true construction of this contract does require him to do something that is not contained in the schedule, it is a very hard contract for him, and a very unjust one. It will be a very cruel wrong to require him to do work for which he was not paid. If that is the true construction of the contract, I say these specifications are



nothing but a trap and a snare, such as a private citizen could not avail himself of with honor; and the Commonwealth cannot.

Now, under this state of things, we come to this contract which he has executed. I maintain, and should maintain with the extreme confidence, but for the circumstance that I understand the attorney-general holds a different opinion, that this contract, when read by itself alone, and without reference to anything which preceded it, or anything which came after it, according to its true construction, does not require the Messrs. Shanly to do any brick arching outside of the west end section. When Mr. Shanly found that there was any difference of opinion on that subject, he wished to ascertain, as definitely as possible, by any means within his won command, what was his position; and he took legal advice on the subject. He consulted Mr. Sidney Bartlett, as high an authority, I am safe in saying, as it was open to him to consult, to obtain a construction of this contract.

Mr. Bartlett took the contract without the specifications, and without considering anything that came afterwards (which, however, I shall desire to refer you to), and gave an opinion, after considering it well, that Mr. Shanly was not bound, according to the true construction of the contract, to do any brick arching except four and a half million of bricks in the west end section of the Tunnel.

His opinion is dated February 6, the day before the petition now before you was presented, and I would like to read it to you.

#### MR. BARTLETT'S OPINION.

On the 24th December, 1868, the Commonwealth contracted with the Messrs. Shanly "to do and perform all the work necessary to complete the Hoosac Tunnel with its central shaft, *in accordance with the schedule hereunto appended.*" The Messrs. Shanly were to furnish all materials, and, after the completion of the Tunnel, lay a railroad through the same, remove all materials, etc., so as to leave the Tunnel and track in complete order, ready for use.

The contract contained this provision: "The size and general description of the work, the estimated amount of the same," etc., are set forth in the schedule hereto appended, *which constitutes part of this agreement.* But no errors in the *estimates* of the work to be done, and materials to be furnished, \* \* \* \* shall *affect the contract price* to be paid for the whole work.

The schedule sets out, as to each section of the work, under the head of "work to be done," an enumeration, in sub-divisions, of the whole work, in general terms, to be accomplished on such section; and, having done this, it adds, as to each sub-division, an estimate of the measurement or quantity of materials which will be thus required to be removed or supplied.

The enumeration of work "to be done on the west end section," con-

tains a provision, as to brick arching, thus, "*arching part of the Tunnel with sound, hard-burned bricks. Amount of bricks to be laid not to exceed 4,500,000.*"

The schedule contains no provision for arching with brick, any other than the portion of the above section, as being part of the work to be done.

The Commonwealth has recently given notice to the contractors, that they will be required to arch, with brick, 1,800 feet of the *central section*, which will require 5,000,000 of bricks, and cost the contractors, for work and materials, about \$300,000; and has further required forty feet of brick arching on the eastern section, which will cost the contractors about \$6,000.

The question is raised, whether the requisitions are justified by the contract.

Assuming, as I am instructed, that the brick arching thus exacted from the contractors, although not requisite for the immediate, full and complete use or enjoyment of the Tunnel, yet may, in the long future, be found necessary to prevent the fall of rock or earth, and that to the perfection and security of this great work, such arching would, by engineers, be deemed requisite, I am, nevertheless, of opinion that it was not contemplated by either party to the contract, and that it is not embraced by any just legal construction thereof.

The grounds upon which this opinion rests, are as follows:—

*First.* It is clear by the terms of the contract, that although the Messrs. Shanly agreed to do and perform "all the work necessary to complete" the Tunnel, yet the character and extent of this completion is qualified and restricted by the words which follow, viz.: "in accordance with the schedule hereunto appended."

*Second.* That schedule defines, with great distinctness, not only the work to be done on each section, in general terms, but also its character and that of the materials to be removed or added, to complete the work under the contract.

*Third.* The arching with brick is the subject of special provision. The minds of both parties were clearly exercised as to it, and its extent and costliness, since they inserted a limitation for the protection of the contractors, viz., the amount of brick to be laid not to exceed 4,500,000.

*Fourth.* With the minds of the parties thus specially called to this feature of the work, this arching with brick is in terms required only for one portion thereof, viz., the west end section. It would be a most unjust interpretation of the contract, to hold, that notwithstanding this special provision for arching a portion of one designated section, yet both parties must have understood and meant, that the contractors might be called on to arch any and all parts of the Tunnel, if good engineering required it.

It remains to find if there be not some other portion of the written contract, which is repugnant to or ought to control the foregoing construction of it.

The contract declares, that no errors in the *estimates* of the work to be done and materials to be furnished shall affect the contract price to be

paid for the whole work. Now the contract contains in detail estimates of the material to be removed and to be furnished. The above provision, therefore, would seem to be applicable to *errors of quantum* in those conjectural estimates.

At the conclusion of the schedule, is the following clause: "It is understood and agreed that the Commonwealth is in no event to be responsible for the correctness of the *estimates* of quantities, distances, etc., given in this schedule, nor shall the *specific details* of work to be done as given therein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, *to be performed under this contract*, nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract."

The interpretation of this clause, requires a reference to the features of the schedule. That schedule at the head of each subdivision declares in general terms the work to be done, and there follow estimates of the amount of excavation, and in many instances, details as to the manner in which the work is to be done. I think the true construction in this clause is, that the work thus required by the general terms of the schedule is not to be limited or affected by any error or omission of detail. That this was its purpose would seem to be clear when regard is had to the words "completion of the Hoosac Tunnel, *to be performed under* (in conformity with) *this contract*." No other standard of completeness is anywhere referred to throughout the contract, and, it may be added, that some standard would in all cases seem to be necessary for the safety of the contractors.

That is Mr. Bartlett's opinion, which I believe will stand the test of examination, and will be found on reflection, not only by lawyers but by practical men, to be a sound, honest and fair construction of the contract. He does not go into any very great detail, and he does not assume in giving a written opinion, to give an argument upon the subject, but only to indicate, in general terms, the controlling views in his mind. There are one or two other matters worthy of attention in getting at the construction of the contract, and the first is this: that the statute under which this contract was made contemplates that this work shall be paid for by instalments, as it progresses from time to time. The specification says:—

"Payments shall be made each month at the engineer's office in North Adams on account of work done during the preceding month, the amount paid to be ascertained by the estimates of the engineer, making a deduction of a reserve of twenty per cent., to be retained until the completion of the contract, and a further deduction of cost or value of any material, labor &c., which may have been furnished for the work by order of the engineer, and of the rents as heretofore provided for."



And accordingly, in the west end section, the brick arching was specified in the contract with a price fixed upon it which should serve as a test of the amount to be paid to the contractors as the work shall go on from time to time; and there are many items specified in these estimates, some of which are pretty minute. For instance, there is the construction of a fire-proof floor in the central section. The estimate for that is two thousand dollars, and when that is done he is to have eighty per cent. of it. Also, repair and completion of timbering central shaft, amounting in all to \$5,830; and iron pipes in shaft, amounting to \$6,180. Now these items, with others that are enumerated, are absolutely trivial in comparison with the work he is now called upon to do, and if it had been contemplated that under this contract he was to be called upon to do an indefinite amount of brick arching in the eastern section and in the central section, some provision would have been made for a payment to him, from time to time, as the work progressed; otherwise he is called upon to provide bricks, and is required to advance \$300,000 for this brick arching, outside of the west end, without any payment to him until the final completion of the work. Now when you consider the statute which authorized this contract to be made, and that the contract itself contained so many details of the work to be done, and contemplates that the contractor is to be paid certain instalments as his work progresses, is it to be conceived of that, where they make these detailed provisions for trifling amounts, they would expect him to go on and do this brick arching to the amount of \$300,000, without making a provision that he should receive payments on account as the work should proceed? And yet this is all anterior in point of time to some of these provisions which are mentioned; for instance, for the laying of the railroad track, he is to receive, as soon as it is laid, and without waiting for the final completion of the contract, eighty per cent.

And then, again, there is a matter to which Mr. Bartlett has referred, but which I wish to state more fully. In this contract a distinction is manifestly taken between "the size and general description of the work," and "the estimated amount of the same."

"The size and general description of the work; the estimated amount of the same; regulations governing the manner of its performance; the rates of progress required in its prosecution; and various general and particular stipulations and provisions affecting and binding both parties hereto are set forth in the schedule hereunto appended, which constitutes a part of this agreement. But no errors in the estimates of the work to be done and materials to be furnished under this contract shall affect the contract price to be paid for the whole work."

They do not say “no errors in the *general description* of the work to be done,” shall affect the contract price; they make a manifest distinction between the general description and size of the work, and these estimates of cubic yards; and although it may be the case, and I believe it is the case, that these estimates were in some cases incorrect, and Mr. Shanly has been in fact required to do a larger amount of excavation than these estimates contemplate, he raises no question on that, because it is provided that no errors in the estimates of the amount of the work to be done shall affect the price. But if an error occurs in the general description of the work there is no provision which says that that shall not affect the price, or that it shall not be deemed material. They undertake to give the size and general description of the work to be done, and if they do not include in that the proper size for brick arching, and if they do not include in the general description information that brick arching is to be done, why that is material, and the words, “No errors in the *estimates* of the work to be done, and materials to be furnished, under this contract, shall affect the contract price to be paid for the whole work,” do not reach such a mistake as that. It reaches the errors in the estimates of the cubic yards, of which the contractor goes on to say in some instances “about.”

Now, if this is not the true construction, I do not know that any other illustration of what might otherwise be required of him could make it any plainer than the illustration which now exists in reference to this brick arching. You will, however, see that there is a specification that he is to make a drain two feet square; but suppose it is found that good engineering requires it to be 4×2 feet; is he required to make it of that size, when it is specified that he shall make it two feet square? So there is a provision that there shall be a façade at the west end of the tunnel; but suppose it is found that there should be one at the east end too, shall he be required to make it, merely because good engineering requires it? So, again, in the central shaft he is required to repair and complete the timbering; but suppose it should be found that, with reference to the ventilation or the caving in of the rocks, the timber lining was not sufficient, and a brick lining of the central shaft was required; then could he be called upon to do that, merely because it was found that timbering was not sufficient and a brick lining was necessary? He might just as well be required, because good engineering called for it, to line the shaft with brick, as to line the tunnel in this section with brick, because good engineering calls for it.

So that I shall submit with great confidence to-day that, according to the true construction of the contract itself, without regard to any of these things which I have mentioned as going before, and with-

out referring to those things which followed afterwards, but simply looking at the contract itself, it is not the law, and it certainly is not just and fair for the State of Massachusetts, under that contract, to call on Mr. Shanly to do brick arching outside of the west end section.

Passing from that, there is another consideration which grows out of it, and it is this: Mr. Shanly will state to you, in testifying, that he himself, at the time he entered into this contract, and from that time until the present, never understood that under it he was bound to do any such brick arching outside of the west end section. If his contract does impose that upon him, in its true construction, it is a surprise to him. Nobody told him that it meant that. His own examination and construction of the contract, his knowledge of what had gone before, and especially of the specifications, and of his computations with Mr. Frost, led him to expect the contrary. He never meant to take this risk, he never understood that he was taking it, and he never supposed that the Commonwealth understood he was taking it. He never supposed or believed that any human being who had anything to do with the making of this contract understood, or supposed, that by the form of the contract he was undertaking to do that work.

Well, now, under that state of things allow me to quote from one of the moralists something which has the sanction also of one of the law writers. It is laid down by Paley in his "Moral Philosophy," that "where the terms of a promise admit of more senses than one, the promise is to be performed in that sense in which the promisor apprehended, at the time the promisee received it." That doctrine is laid down as sound morals in Paley's "Moral Philosophy," and it is quoted in "Chitty on Contracts" (p. 74) as good law.

"It must be the sense," Paley goes on to say, "in which the promisor believed that the promisee accepted the promise." Mr. Shanly will tell you that it never entered into his mind that he was to do that work, that he was to take that risk; he got no pay for it; he was not undertaking to spring a trap on anybody; and he never supposed for a moment that he was bound to do that work, or that anybody supposed he was bound to do it. So that, under that condition of things, I desire you to reflect if it would not be an extremely hard case—even if you should assume, what I do not concede, that this contract when read by itself is a doubtful one—if you find these other elements to exist, that he understood it one way and supposed the State understood it so, and nobody told him to the contrary, and that he had made bids excluding and not including any such work; I say it would be an exceedingly hard thing to do, if the State of Massachusetts should compel him to do



that work, even if he was not losing any money under this contract, as I will show you by and by he is.

The next general consideration to which I desire to call your attention is this: that after this contract was made, the practical construction which was put upon it by both of the parties to it, excludes the idea that he was to do this brick arching. Now, after a contract has been made between different parties, if it is found, immediately afterwards, that they differ in regard to what it means, the construction which the one or the other puts upon it does not of itself carry any great weight, because each of them will be likely to propose a construction most favorable to himself; but if both parties agree in their construction of what the contract means immediately after it is entered into, and for a length of time afterwards, they thus both unite in putting a practical construction upon it which is likely to be correct, and courts of law will act upon it, and honest men will act upon it, too. If they agree in their construction, a practical construction is put upon it, and that is held by the Supreme Court of the United States to be of great, and even controlling influence. In the case of *Chicago v. Sheldon* (9 Wallace, p. 50)—a recent case before that court—this was so decided. Now, I say in this case I will show to you that the Commonwealth of Massachusetts, through its officers, has put a practical construction upon this contract for a series of years—four years—which agrees with the construction which Mr. Shanly puts upon it now, and they have thus recognized that that is the true construction. I have stated to you already that, at the time this contract was put into this form, and the amount of all the items was ascertained and added up, so that an aggregate amount was ascertained of \$4,594,268, Mr. Frost met Mr. Shanly, and gave to him his estimates of the amount of work to be done, upon which Mr. Shanly acted at that time. He gave him those estimates in detail, which Mr. Shanly has now, and those estimates included in the western section an extension of the Tunnel to a certain distance—1,271 feet—of a size to admit of arching by the laying of four million and a half of bricks, and did not include a Tunnel of sufficient size to admit of arching in any other portion. Now, at the very beginning of the schedule, the statement appears that the Tunnel is to be of a specified size. It says, “Dimensions of the Tunnel: In rock, without arch, 24 feet wide in the clear; 20 feet high in the clear. Where arching is required, 26 feet wide in the clear; 21½ feet high above the rail, when laid down.” So that you see that, where arching is required, the Tunnel was, when finished, to be two feet wider, and one and one-half feet higher at top and bottom, than where arching was not required, and that being on the rim of

the Tunnel would make a great difference in the number of cubic yards of rock to be excavated.

Now, when Mr. Frost made these estimates, upon which Mr. Shanly acted, and upon which the total contract price was founded, which was put in at a lump sum (\$4,594,268), he made his estimates in cubic yards; but the cubic yards of excavation which he estimated at that time did not include any allowance for brick arching anywhere except in the west end section, and if brick arching is to be required after this, he has, instead of 16 cubic yards per lineal foot, to excavate about 26 cubic yards per lineal foot—nearly double.

The CHAIRMAN.—Estimating the length at 1,800 feet, it would make a difference of 18,000 cubic yards more.

Mr. ALLEN.—It would; and that, at \$160 per lineal foot, would make an additional expense of about \$300,000, or something of that kind.

The CHAIRMAN.—Is that \$160 per lineal foot for excavation?

Mr. ALLEN.—That includes the brick arching.

The CHAIRMAN.—What would be the cost of excavation alone?

Mr. ALLEN.—The cost of excavation in going round the rim is about five times as much, now that he has gone through so far. It would cost about five times as much to do that work now, as it would have done if it had been included in his contract, and he had known it was to be done at the outset. You see yourself that, now that he has cut the tunnel as he has, it will require him to go round the rim, and take out the rock all round. [Mr. SHANLY here corrected Mr. Allen, and the latter continued:] Mr. Laurie stated five times as much in one of his reports, in reference to work which I thought similar, but Mr. Shanly now says it is a mistake. (See Laurie's Rep.: Sen. Doc. of 1871, No. 233, page 43.)

The CHAIRMAN.—It might be some guide as to what the parties thought about this, and I would like to know how much per cubic yard it costs to do this excavating; not how much it will cost now, but what it would have cost to do it all at once?

Mr. ALLEN.—You have those specifications there, and you can see what he was to do it for.

Mr. GRANGER.—This length is about 1,800 feet, is it not?

Mr. ALLEN.—1,800 feet in the central section.

Mr. GRANGER.—How much further would he have to go for brick arching?

Mr. ALLEN.—The schedule has it, "Where arching is required, 26 feet wide in the clear; 21½ feet high above the rail, when laid down."

The CHAIRMAN.—I would not like to interrupt you, Mr. Allen, but I thought you could answer the question readily.

Mr. ALLEN referred to this item in the contract: "For Tunnel enlargement, \$16 per yard." That was for enlarging the Tunnel where a heading had been driven in, and it had been excavated to a certain size. That is for the east end, is it not?

The CHAIRMAN.—Yes.

Mr. ALLEN.—The Commonwealth had driven in a certain heading, and therefore the price was for enlarging it.

Mr. ADAMS.—Wouldn't it be about the same now in this case?

Mr. SHANLY.—The contract price per cubic yard was \$14 in the central division, and the quantity of rock to be taken out per foot was probably from 9 to 10 yards.

The CHAIRMAN.—You have excavated these 1,800 feet at the size  $20 \times 24$ ?

Mr. SHANLY.—It is not completely finished yet.

The CHAIRMAN.—Well, assume it was done, how much does it cost per foot, under this contract, to excavate that tunnel  $20 \times 24$  feet?

Mr. SHANLY.—It costs the State, to excavate that size, \$224.

The CHAIRMAN.—Now, my inquiry to Mr. Allen is, what would have been the additional cost per foot, suppose you had excavated it instead, at  $26 \times 21\frac{1}{2}$ ?

Mr. SHANLY.—It would have been, at contract price, about \$140.

The CHAIRMAN.—Additional?

Mr. SHANLY.—Yes.

The CHAIRMAN.—So that, instead of \$224, it would be \$364?

Mr. SHANLY.—Yes. I understood you to ask, Mr. Chairman, what the cost to the State would be; I don't say it would cost that to do it.

The CHAIRMAN.—I did not mean that; I meant under this contract. You have been paid for these 1,800 feet, or what is constructed of these 1,800 feet, according to the contract price assigned to it?

Mr. SHANLY.—Yes, sir; \$14 per cubic yard.

The CHAIRMAN.—Making your excavation  $20 \times 24$  feet?

Mr. SHANLY.—Yes, sir.

Mr. ALLEN.—I was stating that Mr. Frost at this time, when he had that computation with Mr. Shanly for the purpose of ascertaining the amount which should be put into the contract for doing this work, made a statement to him of the amount of work which was to be done under the contract, upon which this price was estimated. These amounts, so stated by Mr. Frost to Mr. Shanly, were afterwards published, during a series of sessions, in a series of reports,



and so addressed to your predecessors upon this Committee. In January, 1870 (Senate Documents of 1870, No. 58, p. 11), Mr. Frost gives a statement which bears the title, "Comparative statement of work *required by the contract*, and of work actually done." That report is here, and is as follows:—

			Laurie revised.*
<i>East end.</i> —Tunnel enlargement, cubic yards,	.	4,500	3,948.04
Heading " "	.	28,000	28,483.36
Tunnel extension, " "	.	85,100	85,442.
<i>West end.</i> —Heading enlargement, " "	.	52,800	52,642.98
Tunnel extension, " "	.	82,940	83,280.
<i>Central.</i> — " " (east), " "	.	35,409	35,554.
" " (west), " "	.	46,861	47,053.
		<hr/>	<hr/>
		335,610	336,403.38

He gives his estimates in cubic yards, the same as he gave them to Mr. Shanly, according to Mr. Shanly's figures, which he will produce here before you. The total, as you will see, of solid rock excavation, is given at 335,610 cubic yards. That allows for a rock excavation to admit of the arching at the west end section, but does not allow for an excavation to admit of arching anywhere else.

Mr. ADAMS.—And nowhere is any allusion made to it?

Mr. ALLEN.—No. Mr. Laurie, in 1871, makes the same estimate. In going over these figures, I should say he found a mistake in Mr. Frost's estimates, and reported that there was 5,000 cubic yards of loose and solid rock, not included in the schedule, which Mr. Shanly had got to take out. That was an error in the *estimates*. Mr. Laurie's report of January 25th, 1871, gives the same estimate, but says this: "In addition to the quantity of work remaining to be done, as given in this report, there are, after allowing for excavation for four and a half millions of brick, as provided for in the contract, about 5,000 cubic yards of loose and solid rock, which were not included in the original schedule of quantities, upon which the contract was based." That will be found on page 55 of Mr. Laurie's report, in Senate Documents for 1871, No. 283. No estimate was made by Mr. Laurie, nor by Mr. Frost, then or at any time, which included any excavation for any brick arching, except in the west end section of the Tunnel. Now, Mr. Frost's "Comparative Statements" were repeated year after year to your predecessors upon this Committee, and will be found in the Senate Documents for 1871, No. 55, p. 12; for 1872, No. 250, p. 16; and for 1873, No. 201, p. 17. These reports, thus given year after year to your predeces-

\* Sen. Doc., of 1871, No. 283, p. 33.

sors, were adopted and accepted, and reported to the legislature year after year, and there is never the least intimation, direct or remote, from the engineers or from the Committee, that there is to be any addition to the work required to be done, in consequence of brick arching, outside of the west end section—never. So far as I have examined, I am enabled to state it, broadly, the engineers have never, unless very recently, and in some report not yet published, in their estimates of the amount of excavations required, included anywhere this brick arching which Mr. Shanly is now called on to do; and there is no Act or Resolve of the legislature, no report, message, public document, speech or statement anywhere, that has ever, unless recently, contained any intimation that the Shanlys were expected to do this work. I say that this shows a practical construction which has been put by the Commonwealth and its officers on this contract.

Moreover, in August, 1872, Mr. Frost celebrated the completion of the brick arch with festivities, calling the men together, laying the last brick with his own hand, and saying, "This arch is laid"; and then he called for and obtained the surrender of the lease for the brick-yard, which the Messrs. Shanly had from the Commonwealth, paying a price for it. He called upon them to give up the brick-yard to the Commonwealth, and the Shanlys did so, it being understood all round that they had completed what brick arching they were expected to do.

They had not, however, laid the whole of the four and a half millions of brick, and in July, 1873, they were called on to complete the laying of that amount. The petition sets forth that it was computed accurately, to use up the unused portion of brick; and here is a letter from Mr. Frost to Mr. Shanly, dated July, 1873, in which he says:—

"ENGINEER'S OFFICE, HOOSAC TUNNEL,  
"NORTH ADAMS, MASS., July 19, 1873. }

"Messrs. F. Shanly & Co.—I make the following approximate estimate of quantity of brick *which will be required to complete the arching of the Tunnel, under your contract*:—

West end section, 344 lineal feet, . . . . . 855 M brick.

East end section, 40 lineal feet, . . . . . 106 M brick.

Add allowance for waste in providing quantities at brick-yard. Mr. Holbrook, contractor of brick, informs me that he is now ready to receive your orders, and to proceed with the manufacture of brick for your use.

"Yours, respectfully, BENJ. D. FROST."

In addition to that, the engineers, according to this contract, had to furnish lines and grades of the Tunnel. The contract says: "The

engineer or engineers of the Commonwealth shall give the lines and grades of the Tunnel and the lines of the central shaft, and be responsible therefor." Again it says: "Estimates will be based upon quantity of material which lies within the line of section prescribed by the engineer or engineers." The contract itself says this, and then on page nine there is a paragraph by itself: "Estimates will be made only of quantities within the exterior lines prescribed for the Tunnel."

Mr. TRAIN.—Those being the lines of direction and nothing else.

Mr. ALLEN.—I don't say, nothing else. They were to give lines of direction, grade and size, and they have done it, and given lines and profiles all the way through. Now, I say, that in giving these lines to the contractors, the engineers have never until recently, or unless recently, included any excavation for arching, the Tunnel being excavated of that size which is fixed where no arching is required. I say this shows two things. In the first place it shows that the engineers did not suppose that any brick arching would be required; and in the second place, insomuch as the Commonwealth is responsible for the lines given by the engineer, so far as they have been acted upon by the Shanlys, it is a matter which cannot be gone back upon. The argument upon this point is this, that here is a practical construction put upon this contract by both parties. If the parties had differed, why then it would have been of no account; if one party had been taking one view of the case, and the other party another, there would have been no construction; but where the parties agree, and put a practical construction upon the meaning of the contract, that construction is very strong and is entitled to great weight.

Now, all this has been done with knowledge, on the part of the engineers, that arching would be required, to a greater or less extent, in the east and central sections. It was not supposed at the outset that any such arching would be required; but after Messrs. Shanly had been at work a year or two, it was found out that the geologists had made a mistake, and had misjudged the amount of water to be found there, and the character of the rock. It was found out ultimately that instead of mica slate there was wet granite, and floods of water which would be seriously troublesome. I say it has been known, and this practical construction of the contract by the engineers has been given with the knowledge that there was arching to be done in the east and central sections to a certain extent. Mr. Laurie's Report of September 16, 1869 (Senate Documents, 1871, No. 283, p. 10), mentions a soft seam fourteen feet thick, where arching will be required; and in his report of February 3, 1870, referring to the same fact, he calls it nine feet, but it was



the same seam unquestionably, and he says some thirty feet of arching will be required; adding, "Near the anticlinal axis of the stratification, more arching will probably be necessary." That is on page 24 of that document, and that refers to the central section. He has got so far in then, by February, 1870, that he expresses his opinion to the governor and council. This shows that the engineers of the Commonwealth, so long ago as that—four years ago—instructed the governor and council that they had met with what was not anticipated, that they had met with a character of rock which did require arching to a certain distance, and that near the anticlinal axis of the stratification more arching would be necessary. In March, 1871, water came into the central section, exceeding the capacity of the pumps. (Frost's Report, Senate Documents, 1872, No. 250, p. 10.) In February, 1872, work west from the central shaft was again suspended, and continued suspended until December following, when the eastern opening was made.

Now, the fact that the geologists had made this great mistake became known, and that there was wet granite instead of dry mica slate, and floods of water driving out the men, rendering the prosecution of the work absolutely impossible, instead of there being "no water which would be 'seriously troublesome,'" as stated by Mr. Brooks in his report. Now Mr. Frost knew all about this; he *must* have known about it; he was the engineer in charge; it was obvious to see; he knew the men had been driven out there by the influx of water; and he knew it was directly contrary to what the geologists had thought; he knew all this in 1871 and 1872. In March, 1871, he knew the men had been driven out, because he reported it; he knew they had in February, 1872, because he reported it; and yet, in August, 1872, five months after this last and final suspension, he celebrated with festive entertainment the completion of the arch, calling the men together and saying: "Oh be joyful, for this arch is done." In July, 1873, he speaks of four and a half millions of bricks "completing the contract," and makes no call for brick arching in the central section until January, 1874.

The CHAIRMAN.—Do you claim, Mr. Allen, that the fact of flooding was or ought to have been evidence to Mr. Frost and the engineers that arching would be necessary?

Mr. ALLEN.—I claim that Mr. Frost, as the engineer, could see the danger and judge whether it was necessary or not; there were the same means of judging then as now. I do not suppose that arching for any great distance is absolutely and certainly necessary now; it is only necessary by way of precaution; but there was this information, which was manifest then as now to the engineers, that the geologists had made this great mistake; that instead of mica

slate being found the whole length of the Tunnel, it had changed to wet granite; that instead of there being not enough water to be seriously troublesome, there were floods of water driving out the men and causing the suspension of the work; he had knowledge of this great change in the character of the mountain. Whatever knowledge he has now, he had then. If Mr. Frost was here, I would ask him that question, if he thought arching was necessary; but I cannot tell you myself what he actually thought.

The CHAIRMAN.—I understand you to contend that flooding was, to some extent at any rate, evidence to the engineers that arching would be necessary.

Mr. ALLEN.—You understand, I suppose, that the danger is not that it will fall in immediately, but that it may ultimately fall in. There is no danger from the shaking of the mountain by trains passing through, but the gradual action of the elements, in the course of years, may cause some of the rocks to fall in.

Mr. TRAIN.—On this point, to which your remarks are drifting now, I would say that it was not opened until last October.

The CHAIRMAN.—Do I understand that that is so; that there was no visible fact there which would lead to the belief, except, perhaps, the flooding, that arching was necessary until after it was actually opened?

Mr. ALLEN.—The last blast was put in on Thanksgiving Day; the precise rate of progress which had been made the engineer's reports can show, and Mr. Shanly can show you when the first part of that 1,800 feet was opened; but it must have been some months before that last blast was put in; the dates I have given you of the floods coming in, and the work west of the central shaft being suspended, are correct. It was suspended first in March, 1871, and then in February, 1872, for ten months. Whatever evidence there was to be gathered from that great influx of water, the engineers had. The precise date when that portion of the Tunnel was opened, covered by the present requirement of arching, I am not able to give you myself, but Mr. Shanly can.

Mr. TRAIN.—Allow me to ask you where you got your estimates of 1,800 feet?

Mr. SHANLY.—It is thereabouts.

Mr. ALLEN.—Mr. Shanly says that in the direction which was given to him, it was not specified.

Mr. TRAIN.—And we never heard of 1,800 feet before, so that your estimate of 1,800 feet is a theory of your own making.

Mr. ALLEN.—Well, I don't suppose the distance is material. If you can require him to do 1,800 feet, you can require him to do several thousand feet.

That concludes what I desire to say in reference to that; but there is another aspect of the case which I wish to lay before you, and that is, that this work has cost more than was expected. Mr. Shanly will lose money on this contract, as he sets out in his petition. In one sense, this is no argument, but in another sense, it is. The fact that he will lose money on this contract, and that the State will make money out of it, that the State will get work done for less than it has cost, is no legal reason why he should escape from doing that which he has agreed to do; but when it comes to be a question of whether or not Mr. Shanly shall be required to do the work which he never supposed he had agreed to do, which he never believed, and does not now believe, that he is bound to do, work which he never calculated to do, work which it was an entire surprise to him to be called upon to do, then it is a good argument to say, that the State of Massachusetts ought not to call upon him to do such work, if the work which he recognizes as proper for him to do, under the contract, will cost him more than he is getting for it. Now, with reference to that, I do not want to go into small points. The unexpected finding of a change in the stratification of this mountain, has been set out, and is shown in the various reports of the engineers. Mr. Brooks thought the quantity of water would not be so large as to be seriously troublesome, and so did President Hitchcock; and if the working was suspended going west in consequence of the influx of water, as it was, according to Mr. Frost's report, from March the 21st to October 31st, 1871, and also from February, 1872, to December, 1872, a period of ten months, or eighteen months in all, it will be seen that there was a very large delay caused by that which was unexpected, and also a very large expense, and for eighteen months, instead of hoisting rock out of the central shaft, he had to hoist water; he had to put in heavy pumping-machinery, and to spend money for pumping and lifting up water, instead of lifting rock, as he expected to do. Then, again, the foundation of the central shaft was found to be laid imperfectly, and he had to relay that. That he has never said anything about, until this year, because he did not wish to make any criticisms upon others on that score. But in Mr. Frost's report, printed in Senate Documents for 1872, No. 250, page 10, he says: "On this date (August 7, 1871) they (the new pumps) were started, but the working of a single day developed the existence of unexpected defects in the old foundations upon which the bearings had been placed, and the consequent necessity of a further reinforcement of the construction. So much time was occupied in this additional work that the new pumps were not again set at work until October 2d." Mr. Frost himself mentions it, and this was work which had been done by the State.



Then there were various other matters, which have been set out in the petition, which I will not dwell upon at this time. There was, however, a great additional expense incurred, to be reckoned by hundreds of thousands of dollars, completely absorbing all the expected profits, and leaving the Messrs. Shanly, at the best, as losers, if they did simply that work which they admit they were obliged to do, so that it leaves them nothing, except the credit of the work; it leaves them no money for five years' work there, for five years' time, for risking all this capital, for encountering and overcoming all these obstacles, for accomplishing all this result; it leaves them nothing but the credit of the thing. They have pursued it with an energy such as very few contractors have ever shown; they have rescued this enterprise from failure; they have rescued it from the discredit into which it had fallen, and made it respectable; they have done the work, they have accomplished and completed it, so far as any real difficulties are concerned; there is nothing now to be done, except days' works, which can be done under the superintendence and supervision of anybody. It does not need persons of the position or quality of Mr. Shanly to complete that Tunnel now, because it is easy; they have done this work under their contract, and done everything which, in their opinion, has been required of them under that contract, and they will still be losers. They have never troubled the legislature with captious inquiries; they have not been always around the State House; when they have had an application to make, they made it to the Committee; they have sustained a reputation here in Massachusetts for high honor second to no ~~other~~ citizens of the State. If you go to North Adams where they are known, there is no man whom they have defrauded, no man with whom they have driven a sharp bargain, no man to whom they have done injustice; and you will have the means, if you will, to know with what fidelity they have done their work, with what energy they have followed it up, and with what success they have combated the real difficulties of the situation. And, after all, the State of Massachusetts is to make money out of them; they have taken their risk, and they have lost money, and they are contented to lose money according to the terms of their contract and its just construction. But when they are called upon to do work which they never undertook to do, which their contract does not justly require them to do, or which, if, according to the strict legal construction of it, they are bound to do they never understood they were called upon to do, and never intended to undertake, certainly it is a fair case for the contractors to come in and ask the Commonwealth of Massachusetts to give such a construction to this contract as is conformable to justice, to simple justice, as between man and man. Now, in

their condition, they ask you to give such a construction to their contract as will exonerate them from the call to do this arching, and that you will consider that it is not just, nor right, nor reasonable, to call on them to do this work.

Then there is their further application for an extension of their time, which perhaps is not necessary here, for I do not know that the governor and council have any doubt of their right to extend the time until September 1st.

Then they further ask, as a measure of relief from financial pressure, that upon looking at it and finding what the present financial condition of the work is, how much the Commonwealth still have in their hands, you will cash for them \$200,000 worth of their certificates of indebtedness.

I had no intention, Mr. Chairman and gentlemen, of making my remarks so long, and I should have no excuse for doing so, had I not introduced in my statement the bulk of the evidence we expect to produce before you. I wish to ask Mr. Shanly a few questions, and if Mr. Frost was here before you I should be very glad to put a few questions to him.

Mr. TRAIN.—Before you sit down, Mr. Allen, that I may better understand this whole question, I would like to have you indicate what form of legislation you ask under this petition—what sort of a statute or Resolve you would ask the Committee to report? I would like to know whether this is a petition for relief under this contract, or one asking the legislature to give a judicial construction of an act already made, if you catch my idea.

Mr. ALLEN.—I have not drawn any bill or Resolve, as I did not suppose it would be my duty to do that unless the Committee should call on me to do it, and in that case I should be very happy to do so, under instructions from the Committee as to what decision they had arrived at. Mr. Shanly contends that, according to the legal construction of his contract, even the dry legal construction, he is not bound to do that work; and that if he is wrong in that particular, still it is not just that he should be called upon to do it, and he asks that the legislature shall give an authoritative construction to this contract, so that under it he shall not be required to do that work. Now that construction may be a purely legal construction, or it may be according to justice, according to what the legislature would consider to be just. I have undertaken to submit this question here in both its aspects,—in its legal aspect, and in its aspect of justice and honesty, and I desire to ask the legislature, for such reasons as may seem good to it, to say that the construction of this contract does not require this brick arching to be done.

The CHAIRMAN.—Why wouldn't this be a good thing to do, Mr.

Allen. For you to draw up in the form of a Resolution or a statute, or both,—put it into as many forms as you please,—the conclusion to which you desire the legislature to come, and in that way frame the issue which the attorney-general can have and know how to meet, making the stipulation that you should not be confined to any particular form. Make it a statute, or make it in any of the various ways which may occur to your own mind, and arrive at the result that you desire to have the legislature arrive at.

Mr. TRAIN.—My difficulty is, Mr. Chairman, if I may be allowed to state it, that if this is an application for equitable relief, I have no occasion to be present, ought not to be present, nor should I deem it my duty to interfere in any legislation in that direction which the legislature might think fit to adopt, under your report. If it is a question of judicial construction, I am directed by the governor and council to appear, and if it is a legal question it cannot be settled by the legislature, but only, authoritatively, by the supreme judicial court, and that question we have offered, since Saturday last, to submit to that tribunal for decision. If I am to discuss a question of law, that is one thing; if it is a question of whether these gentlemen, having made a contract on which they have lost money, should have relief, I have nothing to say about it. Therefore, I wish Mr. Allen to state, so that I may know, what issue I am to meet. If they wish a decision of the question of law, it is apparent enough to the Committee now that we desire to go to the only tribunal that can settle it, and have it settled within thirty days. I do not wish to come here and discuss propositions which are entirely inconsistent. If he will ask you to report a bill giving relief, then the Committee will not undertake to pass upon the other question. I do not see how the two questions can be combined in this discussion.

Mr. ALLEN.—I do not see any incompatibility at all. We express our opinion as to what the true legal construction is. We do not think the true legal construction binds Mr. Shanly to do that work, and have come to the legislature saying so. One cannot, however, be over-confident in giving an opinion against the attorney-general, and if we are mistaken in that view, we would like to have the legislature authoritatively state that, on considerations of justice, Mr. Shanly shall not be called upon to do this work.

Mr. TRAIN.—A legislative judicial decision is not a thing which I understand.

Mr. ALLEN.—The legislators may decide the question, some on one consideration, some on the other. One man may say, "I decide this way because I consider it the true legal construction of the contract"; and another may say, "I decide the same way because I think it just and right, whatever may be the legal construction of the



contract"; and the conclusions would be the same, the result would be the same, whilst one member of the legislature would be governed by one reason, and the other by another. I do not see that there is any incompatibility in presenting the question in this way, each member being governed by such reasons as are satisfactory to himself.

Mr. TRAIN.—Now I wish to suggest to brother Allen that the way in which he proposes to leave this question puts the Commonwealth in apparent opposition to the legislature, whereas, if he comes and asks relief, I have not a word to say. The executive have construed this contract, it was the duty of the executive to do so, and upon that branch of the inquiry we are in opposition, and the executive is in opposition to the Shanlys, but the moment the Shanlys come here and say "We want equitable relief," we are dismissed from the discussion, and have nothing to do with it.

Mr. ALLEN.—You don't expect Mr. Shanly to admit that your construction of the contract is correct?

Mr. TRAIN.—I don't care what Mr. Shanly admits. I don't want you to put the executive in a false position. I think they have done everything that can be asked of them in offering to submit this question to the highest tribunal, and I think if the Shanlys decline that proposition, they should not be allowed to discuss this legal question, but should be put on the other ground.

Mr. ALLEN.—The suggestion is that we cannot come here to press a petition of this kind without giving up our legal claim and ground, but I submit we are not called upon to do any such thing. We do not want to give up that question. If Mr. Shanly has got *any* ground to ask for this legislation, whether it has its foundation in law or in equity, then we want it. We cannot justly be called upon here to give up the assertion that we are right in law, in order to lay the foundation for the legislature to consider our equitable claim.

Mr. TRAIN.—I don't want you to give up anything; on the contrary, I want you to get the benefit of both grounds.

Mr. ALLEN.—If the legislature can look at it for themselves, and decide it, why, then, there is no occasion to go to the supreme court.

Mr. TRAIN.—Well, sir, but the legislature passing upon it don't settle it any more.

The CHAIRMAN. This is a new subject to me, and any suggestion I should make in reference to it, I should feel at liberty to change upon reflection. It seems to me, however, that the State of Massachusetts is a contracting party here with the Shanlys; that the State of Massachusetts is represented by the legislature; that the legislature have the same power to deal with this contract that any party would have; the same power as the Shanlys have; the same

power to deal with the contract as if it were not the State of Massachusetts, but some private individual. Now, here is a difference of opinion between the agents or representatives of the State, to whom is entrusted the execution of this contract, and the other contracting party. Now, the parties get together; the legislature on the one side, representing the State; the Shanlys upon the other. The Shanlys say to the legislature: "Even if we are wrong about our view of the construction of this contract, we think the circumstances are such that you ought to yield your claim; and we think also that you ought to be convinced that you are wrong, and that we are right. Now, let us agree together in reference to this matter, and you yield this point, which the executive claims to be the true construction of this contract." Now, while I don't undertake to indicate what the exact course of legislation should be under the circumstances, it seems to me that there is no practical difficulty in dealing with the subject.

MR. SLEEPER.—I would like to inquire, Mr. Chairman, if it would not be important to consider whether it is to be understood that the Shanlys are to abide by the decision of the legislature.

THE CHAIRMAN.—I suppose they would be obliged to abide by the decision of the legislature. I don't know what remedy they could have.

MR. SLEEPER.—By appeal to the supreme court on the construction of the contract.

THE CHAIRMAN.—Could they do that?

MR. ALLEN.—We cannot go to the supreme court unless the legislature gives us the right to go there.

THE CHAIRMAN.—Suppose the legislature were to decide that they must do this work, I don't know of any remedy they have.

MR. TRAIN.—I understood you have said, not now, but on a former occasion, that if the final result was that they must go on with the work, they must stop right where they are.

MR. ALLEN.—Yes.

MR. TRAIN.—And that embarrasses me still more.

MR. ALLEN.—They never calculated to arrange for this amount of \$300,000; never thought of doing so until January, 1874.

THE CHAIRMAN.—The offer has been made, as I understand, from the attorney-general to Mr. Shanly, to submit this question to the supreme court, for the construction of the contract?

MR. ALLEN.—Yes, sir, on the question of law.

THE CHAIRMAN.—And that offer has not been accepted?

MR. ALLEN.—Nor declined. If the legislature will not do anything for us, but let us go to the supreme court, we shall go there. We have no choice in the matter; we have to take such good as the

gods may send. If the legislature allows us to go to the supreme court, we have to go there; if they allow us to go to an arbitration, we go there; what we would like is, that the legislature should consider the question themselves, and decide it on the question of justice.

Mr. GRANGER.—I understand that the legislature of the State has a perfect right to determine that contract.

The CHAIRMAN.—As a judicial tribunal?

Mr. GRANGER.—Yes, sir, as the law-making tribunal of the State.

The CHAIRMAN.—I have not any doubt that the legislature has the right to say that the Shanlys shall or shall not do that work under the contract, and, perhaps, the power of declaring, by statute, what the construction of the contract is. It seems to me to come rather in the nature of relief, after all, whatever else you may call it. If it is not a relief from the obligation, it is a relief from the embarrassment of having two opinions as to whether there is an obligation or not. I should like to hear the attorney-general's views upon it.

Mr. FULLER.—It is a question of relief, and I don't see that the attorney-general has anything to say on the question.

Mr. TRAIN.—If it is a question of relief, I don't anticipate that the governor and council have anything to say upon it. It is their duty now to see that the contract is executed as they understand it; and where the Shanlys get the ability to execute the contract from, the legislature or anywhere else, is another matter.

Mr. FULLER.—The trouble with the governor and council is, that they have no power to vary this contract. The legislature has the authority to vary this contract; the governor is the agent of the Commonwealth to carry it out.

Mr. SLEEPER.—I suggest that we have a meeting of the Committee to consult with regard to the course we shall pursue.

[A consultation of the Committee was then held.]

Adjourned to Friday, February 20, at 10.30 A. M.

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FRIDAY, February 20, 1874.

The hearing was resumed at 10½ o'clock.

The CHAIRMAN.—The Committee have had a conference with reference to the matter discussed yesterday, and without now undertaking to indicate what the issues may be, have determined that, under the memorial which has been referred to them for considera-



tion, it is their duty to proceed and hear whatever may be offered on either side, and leave the question as to what shall be done with the evidence to be determined after we have heard it.

STATEMENT OF MR. WALTER SHANLY.

*Mr. Chairman and Gentlemen of the Committee:—*

To begin at the beginning of this matter, the idea first occurred to me and my partner to make a tender for the construction of the Hoosac Tunnel in 1868. We saw that the State had appropriated a sum which was then estimated to be sufficient for the completion of the whole work. That sum was \$5,000,000; and knowing that the work upon the Tunnel previously had depended upon legislative grants from year to year, we thought that the fact that the legislature had determined to grant the above sum, indicated that it was their intention to go on and complete the work, and that the contractors would not be troubled, as others had been theretofore, to come to the legislature from year to year and ask for an appropriation to carry forward the work. We, accordingly, invited by an advertisement in the public papers, went to North Adams for the purpose of examining the work for ourselves. We found that there were several other contractors there on the same mission, and we went, as we were invited to do by the advertisement, to the state engineer's office there, and, seeking information from Mr. Frost, this document which I hold in my hand was given to us, as the form of tender on which we were to make our offer to the State for the work. We saw a great deal of the engineer during the time we were there. He accompanied us, with several other contractors, over the mountain, and also into the Tunnel, and answered our questions at the time very fully. He stated to us that the work intended to be done on the Tunnel was fully set forth in the printed document referred to, and that the tender was to be made in such a way as to provide for what is called an item contract. That is to say, we were to be paid so much a yard for every yard of rock we took out, and so much per thousand for every thousand of brick we put in, &c., and the quantities estimated were as set forth in this document. The document is divided, as the present contract and schedules are, into three sections; there is the east end section, the central section, and the west end section. The work specified in the east end section is comprised entirely of rock excavation, including the excavation and construction of a central drain, and the furnishing and laying of one track when the Tunnel should be completed. In regard to the central section, the document provided in the same way for furnishing the shaft, which had then been sunk rather more

than half its ultimate depth, and it also provided for excavation of the Tunnel east and west of the shaft, no kind of provision being made for brick arching anywhere except in the west end section. We found at the time that provision was made for arching a portion of the west end section with brick, and that for that portion of the Tunnel the quantity of excavation provided for was amply sufficient to allow of brick arching being put in, but none in the east or central section. In this document the number of cubic yards to be taken out was distinctly stated as sixteen cubic yards, nearly, per running foot, in "rock Tunnel"; but for that portion which was estimated for brick arching, the quantity to be taken out was from twenty-five to twenty-eight cubic yards per lineal foot; and in answer to inquiries which were made of the engineer, he stated that the measured length of brickwork to be done, per lineal foot of Tunnel, was something over 1,200 feet, some 930 feet having been already done by Mr. Farren.

Having got all the information we could from the engineer, and having thoroughly examined the mountain for ourselves, and satisfied ourselves as far as we could from outside indications that the mountain was composed of mica slate, as all the geologists who had examined it previously, as well as engineers and contractors, had concluded it to be, and believing that this mica slate rock extended to the summit and to some distance down the western slope, as was the opinion of the eminent geologists and men of science who had examined the mountain previous to ourselves, we made a tender, of which this paper which I hold in my hand is an exact copy. It is an "item" bid at so much per cubic yard of rock taken out, so much per thousand of brick put in, and so much per lineal foot of drain to be made in the centre of the Tunnel.

Several months elapsed and we heard no more from our tender, and concluded that it had not been accepted, when we received a communication from the secretary of state requesting us to come here and have an interview with the governor and council. We did so, but that interview resulted in nothing, because the requirements in regard to securities were such as no contractor would comply with. We waited another month or so, when Mr. Tappan Wentworth, one of the commissioners, came to Canada and requested us to come to Boston, which we did. We then had another interview with the governor and council, and discussed the question fully upon this tender, which was then lying upon the table in the council chamber. We then retired, at the request of the council, and waited in the ante-room. Shortly afterwards, the then lieutenant-governor, Governor Claflin, came out and told us that the governor and council had decided to accept our tender, and that in a few

days they would be prepared to proceed to the execution of the contract and enter upon all the details. My brother then returned to take care of our business elsewhere, and I remained in Boston to discuss the question of the contract with the authorities.

When we entered upon the discussion of the contract, upon the several items, a suggestion came from some member of the council, I forget whether it was Governor Bullock or some other member, that it would be more convenient if we took the contract in a bulk estimate, stating what we would do it for in a lump sum, instead of making a contract upon this "item-bid" of ours. In answer to that, this difficulty arose, that we had not measured the work, as it was not easy to do so. If we were to be paid, as we supposed we were to be, for every cubic yard of rock we took out, every thousand of bricks we put in, every mile of track we laid, and every foot of ditch we cut, &c., &c.; if we were to be paid by "the item," there was no occasion to measure the work beforehand. In reply to the question whether we could measure it then, I said it was impossible in the time which could be allowed; that it was a work of very considerable difficulty and requiring a great deal of time and care. It was then somewhere about the 15th of December, and I understood that the governor and council wanted the contract executed before the close of the year. Then the question was asked, if I would accept the engineers' measurements and make a bulk tender upon that basis. I at once assented, provided the engineers, Messrs. Latrobe and Frost, then present, would assure me that the quantities had been carefully and accurately ascertained. I was answered in the affirmative, that they had been; that I might rely upon the quantities; and thereupon I said I would make a tender in a bulk sum upon the estimate. I was then requested by the council to go with Mr. Frost and take a day, or two days if necessary, and sit down with him, and, by applying the prices in my schedule bid to the quantities which he assured me were correct, get at a bulk sum. We spent a day and part of the night together (I remember that I was with him far into the night at his brother's office, in Cornhill), and in that way we arrived at the bulk sum, which was \$4,594,268. That is the exact way in which it was arrived at, and this the exact schedule which Mr. Frost and myself made up, with the exception of the last few items, which were subsequently added in the council chamber,—such items as a façade at the west end of the Tunnel and one or two other supplemented things. In every other respect as regards the quantities of excavation, the amount of brickwork, and so on, the schedule I now submit exactly conforms to that which Mr. Latrobe and Mr. Frost said were the quantities of work to be done in the Tunnel. Afterwards, when the contract was being



drawn up, the schedules of which that is a copy were made part and parcel of that contract; and I would simply say, that no contractor in the world would have risked taking a contract unless schedules defining the quantities of work he was to do were so made part and parcel of the contract. It was our understanding at the time, that we were to do that much work and no more for our money; and I think, Mr. Chairman, that this Committee will see that it would have been a most unjust contract, a most one-sided contract, if we had taken the enormous risks that would have been involved in undertaking to do all and every kind of possible or impossible work, such as could not have been set forth in distinct terms in the schedules.

The quantities there mentioned were estimated by the engineers as all that were required to complete the Tunnel, and we accepted them as such. If those quantities merely turned out to be incorrect, and should prove afterwards to be in excess of what are stated in the schedules, we took the risk of that; but we held then and hold now, that the introduction of any new item would be simply making us responsible for any possible amount of work, and that the State might get possibly a million dollars' worth of work from us more than we bargained to give. That is to say, the change in the character of the rock, which has given rise to this brick question, might have occurred, as a mere accident of nature, a mile this side of the central shaft, and if it had so occurred it would have involved an extra expense, not of \$300,000, but of a million or more dollars. It cannot be possible, we hold, that the State ever contemplated throwing upon us an additional amount of work to the amount of a million of dollars more than is included in the schedule. We hold and have always held, that the schedule defines exactly what we are to do, and that if any items go into the schedule they are extra items and outside of the contract.

I will say as regards the brickwork, that when we came to discuss that question as respects the western division, that the original schedule contemplated but four millions of brick for the completion of the arching, and these four millions of brick were supposed to arch 1,270 feet of the Tunnel, neither more nor less. When we came to make the contract, the question came up as to whether these four millions of brick would be sufficient to safely complete that part of the Tunnel. It was said that the ground might be so bad as to require an extra thickness of arch; and upon that supposition, and to provide for such a contingency, it was agreed that a half million more of brick should be added. Hence it is, that in the schedule attached to the contract, with regard to the west section, the quantity, instead of four millions, as it was in the original

tender, is increased to four millions and a half. But in adding that half million it was never contemplated that the distance should exceed 1,270 feet. It was simply to provide for a thicker arch, in case it should be necessary, within the limits of that 1,270 feet; all of which we finished in 1872.

The CHAIRMAN.—I would like to ask you whether any portion of the Tunnel which you have arched on the west section was excavated at the time when you made this contract?

Mr. SHANLY.—There was what is called “adit” or small heading, driven through about four feet by six, enough for a man to crawl through. It was done for the purpose of drainage. That was 1,270 feet long or thereabouts, and it developed bad ground in some places; that is what we call “demoralized rock.”

These are the simple facts in regard to the way in which this tender was made up. I repeat that we held that for our protection it was absolutely necessary to have clearly defined what we were to do, and it appears to us that even if we supposed the legal construction of the words of this contract should be such as to make us liable to do this extra amount of work it would be so unjust, and the State would be getting so much more than they ever expected to get, that I cannot help thinking that if any such thing had been suggested at the time, if it had been presented by our counsel at the time that the contract might be so construed as to involve us in an expense of a possible million of dollars more than was anticipated or expected, the governor would have instructed the attorney-general to so frame the contract as to relieve us from such liability. Therefore we feel to-day that if the construction of that contract is such that we are liable to an unlooked for outlay of \$300,000 (it happens to be only that amount, but it might have been a million), if, I say, the wording of the contract is such that we can be held liable to that extent, I cannot help thinking, taking an equitable view of the matter, that the legislature has power to say, “these gentlemen are not liable for what they did not expect or anticipate.” Therefore we have come before the legislature to call them to rectify what seems to us to have been an unintentional error at the time, a wording of the contract in such a way as the representatives of Massachusetts never intended it should be worded, because, as I said before, there is no contractor in the world who would take such an enormous risk as is involved in the principle laid down, that whatever might happen in the mountain, we are bound to do the work, whether it subjects us to an expense of \$300,000 or \$3,000,000, because that in fact is the principle laid down here.

That is a simple statement of facts. The tender was made in that

view and in no other view, and I would say again, that it was made a bulk tender at the suggestion of the governor and council.

Q. By Mr. SLEEPER.—I would like to inquire, with the permission of the Chairman, if at any time during your interviews with the executive department or with the engineer while the contract was under discussion, there was any allusion to anything that might possibly arise to be done outside of this schedule?

A. Nothing whatever. The schedule was laid down as the work we had to do, and the very opening clause of the contract states that it is a contract to perform the work embraced in the schedule thereunto appended.

Q. There was no discussion of anything else?

A. None whatever. It was supposed that the five million grant which the legislature made in 1868 was ample to cover all the work in the schedule, which embraced all that Mr. Latrobe's reports, and the other reports which were published in regard to the Tunnel, set forth as required to complete the Tunnel. It should be borne in mind, that when we undertook to do the work, a certain portion of the five millions had been already expended. The Chairman put the question to Mr. Allen yesterday, whether the quantities mentioned in the original specifications, applied to our prices, would make the bulk sum named in our contract. They would not, and for this reason: those quantities represented the work remaining to be done in August, 1868, when proposals were asked for the work; the State continued work upon the Tunnel, however, until, I believe, the end of October, so that when we came to make our contract in December, the quantities were reduced, and therefore, applied to our prices, they would not make as large a sum as they would have made in August.

Q. By the CHAIRMAN.—Have you any memoranda by which you can furnish a statement of the work that had been done by the State between the time of submitting the proposition and the time of making the contract?

A. No, sir: those never came into our hands; they were not our property. The engineers, I presume, could do that.

Q. Is this 1,800 feet which you estimate as requiring arching continuous?

A. It is continuous. It lies west of the central shaft.

Q. And immediately west?

A. We had penetrated down the shaft, and found at the bottom of the shaft the same rock which it had been concluded existed all through the mountain from east end until the westerly slope was reached,—mica slate. We proceeded to tunnel west of the central shaft, and when we had got about 350 feet, we struck rock of a



different character, which gave out much water, and it became at once apparent that we were in a different strata. We were in wet granite or syenite.

Q. Can you fix the time when you reached that work?

A. We reached it somewhere about March, 1871. The work was almost wholly suspended west of the central shaft for eighteen months. We made an effort to proceed, working in that rock, but finally abandoned it in May. We concluded to put in very large pumps, to enable us to work eastward, but found that the central shaft would not be sufficient for the pumps that would be necessary to remove the water, were we to continue working westward. We had not made much progress westward from March until May—just enough to satisfy us of the necessity of suspending work in that direction.

Q. In May, 1871, you abandoned the work on this rock, and did no more work there for eighteen months?

Mr. ALLEN.—They did not do any more work for some months. It was resumed in the fall, and they did some more work.

Mr. SHANLY.—Only a trifle, perhaps 25 feet.

Q. You did some work, then, in this kind of rock?

A. We resumed it in December, 1872, finally. It was suspended substantially for eighteen months.

Q. What did you do in the year 1871, after having first abandoned it in March?

A. I think likely sixty or seventy feet would cover what we did in 1871. I can't recollect just now.

Q. And then were you again compelled to abandon it on account of the water?

A. Yes, sir, we abandoned it. We found it was no use to try to advance.

Q. When did you engage upon it again?

A. We engaged upon it again immediately after connecting the eastern heading, because, until then, the water had all to be pumped through the shaft.

Q. Can you fix that date?

A. We found the easterly headings on the 12th December, 1872. We took a certain time to re-arrange our machinery for the westerly heading, and I suppose we began to use that in December. I think we had only done 25 feet in the month of December.

Q. And then did you proceed continuously?

A. Yes, sir, very rapidly. From the 1st of January we proceeded very rapidly westward, never stopping for a moment, so to speak.

Q. Working through this wet granite?

A. Yes; working through the wet granite.

Q. Were the engineers of the State there, supervising and superintending your work?

A. Oh, yes; all the time.

Q. I have understood, from what has been said before, that in July, 1873, you had some information from the engineer, either that the work required arching, or that you were required to do it. What was that information?

A. No, Mr. Chairman, we had not. But in August, 1872, we had, as we supposed, furnished the west end arch, the 1,271 feet; but the four millions and a half of brick which the contract provides for were not absorbed.

Q. You are addressing yourself to another subject.

A. No, I am coming to the letter of July, 1873, to which you refer. In July, 1873, we received a letter from Mr. Frost, twelve months after the completion, as we supposed, of the west end arch, stating that we must extend that arch some 340 feet beyond the 1,271 feet, and also saying that we must build 40 feet of arch in the east end, not the central section.

Q. That communication of Mr. Frost had no reference to this 1,800 feet?

A. None whatever. It exactly uses up, as nearly as can be, the balance of the four millions and a half of brick which had been allowed for the west end arch, completed, as we supposed, twelve months before.

Q. Is that 340 feet continuous from the point where you left it, or does it commence at some other point?

A. About 260 feet is an extension of the arch that we furnished, as we supposed, in 1872. The other 80 feet is to brick one or two soft places within the limits of the western section.

Q. That 340 feet was no part of the 1,800 feet?

A. None whatever.

Q. And then you had about forty feet, or such a matter, in the east end?

A. Yes, sir.

Q. Which the engineer supposed it was necessary to arch?

A. Undoubtedly; and which we also knew it was necessary should be arched.

Q. And although that was not in your contract, as it absorbed the balance of the brick which was provided for in your contract, you put that in?

A. No, we have not put it in. We have done nothing, because then it was coming on so late, that the most we could do was to get the brick made. It took us so long to get the million of brick

which was required to absorb the balance of the four million and a half, that it was too late in the season to do anything more. We have not laid any portion of the extended arch called for, but the brick is there.

Q. You have done no portion of the 340 feet?

A. Nothing beyond providing the material, and doing some of the excavation.

Q. You contemplate doing that?

A. The 340 feet, yes, but we objected at once to the 40 feet at the east end. We promptly denied that that was in our contract. There is no doubt that they have the right to make us put four million and a half of brick in that west end, and we are ready to do it, and have got the material. We do not question that. We may possibly question the expediency of making any brick arch at that particular point, but we have no right to refuse to do it.

Q. I am quite certain that I have a wrong impression with reference to some of these facts. When was it that you first had any intimation from any source, either the engineers or the executive department, that you were required to brick any portion of this 1,800 feet?

A. We had this intimation on the 21st of November, 1873. We had a letter from His Honor, Lieutenant-Governor Talbot, written as chairman of the Hoosac Tunnel Committee of the Council, stating that we must proceed at once with the arching that Mr. Frost had ordered in the east and west divisions; that is to say, the 340 feet in the west division, and the 40 feet in the east. But that letter made no allusion to any other arching, beyond saying that the governor and council took the view that wherever arching was ordered, we would be required to do it.

Q. Have you that letter?

A. I have. [Letters of Oct. 31st and Nov. 21st, 1873, read.]

Mr. SHANLY.—With regard to the quantities of rock, which you have just read out of that letter of His Honor, Mr. Talbot, I may say, from the quantity of rock which it states still remains to be excavated to complete our contract, no additional brick arching was then contemplated; the quantity mentioned being what was needed to complete the Tunnel to ordinary "rock" size only. So that it appears that the engineers, up to that time, did not contemplate these 1,800 feet of additional arching.

Q. Now, you received by due course of mail the order of October 31 and the letter of November 21. At that time, had you been informed by the engineers, or anybody, that you would be required to do this 1,800 feet of arching, or whatever it may be, which we are talking of?



A. No; the question never came up. Nothing was represented to us by the engineers until the 6th day of January of this year. Then, in conversation with Mr. Frost when he was at my office, he referred to these matters, and asked me if it was not my opinion that there was a great deal of arching to be done in the central division. I said, "Mr. Frost, undoubtedly; I have always been of that opinion since the day we struck the wet granite. I have had no other opinion or feeling about it." After considerable conversation, in which I told him that it was not in our contract, he left, and the next day I received a letter directing me to proceed with excavation necessary for the brickwork from a certain point towards the central shaft.

Q. The excavation which you now speak of is an additional height of a foot and a half and a width of two feet?

A. It is much more than that.

Q. That is the additional excavation?

A. Oh, yes, a great deal more than that. The width of the brick walls alone will be anywhere from two to three feet, so that the additional excavation will be from four to five feet all around the Tunnel to allow for the thickness of the brick more than the rock size of Tunnel, and, besides that, the brick arch finishes a larger section than the rock-section.

Q. By Mr. SLEEPER.—Is the schedule-size in that contract the inside size?

A. Yes, sir, it is the inside size.

Q. By the CHAIRMAN.—Whatever excavation is necessary for arching, that is what you were directed to do on the 7th of January by the engineer?

A. Yes, sir, precisely so.

Q. In the construction of the Tunnel, what work do you do first? Is it the outer rim of the excavation or the inner?

A. The outer rim. What we do, first of all, is what we call "heading." We drive a heading through from six to eight feet high, and it is cut to the outside rim of the excavation; afterwards, we cut out the bottom.

Q. Yes, I understand now. That heading would represent the top of the Tunnel, I suppose?

A. Well, it did at the east end, but in the central division it did not represent the top of it. Owing to peculiar circumstances there, we ran our heading partly in the middle of the Tunnel, for certain local reasons,—mainly to facilitate drainage. The Tunnel, you will remember, gentlemen, runs upwards east and west, both ways, to the central shaft. For instance: in running our heading here, we could not run upon the top, as we did coming from the west end, for the

reason that it was too wet; the water would flow in, and the men, if we worked "down grade," would have to work in the water. Therefore, we ran our heading on an ascending incline from the central shaft. We started here on what we call the bottom, and by the time we joined the west end heading, the heading from the central shaft had reached the top of the Tunnel. In that way the water ran back from the heading towards the shaft. It is one of those things that a contractor does to suit himself. We wanted to keep the men in "dry workings."

Q. By the CHAIRMAN.—What my inquiry was leading to was this: I want to know whether any portion of that 1,800 feet had been excavated on the 7th of January to the full size?

A. Not exactly to the full size; on the top it had but a wedge; on the bottom it had still to come out.

Q. You are at work on that now?

A. Yes, sir, part of it was taken out after we joined the headings in December. The piece left there (showing a diagram) in the top, is about what was left on the 7th of January. The rest, as shown on diagram, is all, or will be, out at the end of this month. There will be no top to come out at the end of this month; there will be only bottom work left.

Q. By Mr. ADAMS.—How far was that from the central shaft?

A. I should think about 1,800 feet, speaking from memory.

Q. By the CHAIRMAN.—As I understand, then, during the construction of that 1,800 feet, at any rate, you received no intimation that you would be required to do any more arching?

A. And coming the other way, also, there was a little more done. We were working both ways on the roof.

Q. That is, a portion of that 1,800 feet was at the other end?

A. Yes, sir, but the wedge was very thin.

Q. Then, down to the 7th of January, when you received this intimation from the engineer, you had constructed, so far as the top was concerned, 1,800 feet, and some at the other end, of a size not sufficient to do arching?

A. Perhaps the plainest way to put it is, that of the 1,800 feet, there was somewhere between 500 and 600 feet remaining to be done on the top on the 7th of January.

Q. Suppose, Mr. Shanly, it had been understood by you, as it was with reference to this west end, that you were to construct this 1,800 feet of a size sufficient to arch it, how differently would you have done the work from what you did do it?

A. Do you mean, supposing that we admitted that we could be required to do it?

Q. Yes, sir; take this 1,200 feet, which you say was completed

on the 7th of January, as far as the top was concerned, how differently would you have done that work, if at all different, if you had understood that you were to make it of a size sufficient to arch it and to brick it?

A. If we had understood that it was part of our work to do this arching, I would have driven my heading, to begin with, the extra five feet in width; I should have taken out a heading large enough for the brick arch; I should have been working on it twelve months before the headings were joined. It ought to have been from four to six feet wider, to suit the brickwork; and if I had thought that the brickwork was my business, I would have driven the headings that much wider, and carried on the work of enlarging the Tunnel afterwards, on the same principle, large enough for the brickwork.

Q. Is that a matter which engineers understand as well as you?

A. They ought to do so; there may be a difference of opinion, perhaps, as to how to do such work; I have often seen two engineers differ as to the best way of doing work.

Q. By Mr. ALLEN.—That it may be distinctly understood, I would like to ask you whether, at the time this contract was made, anybody told you that there might be, in their opinion, any brick arching to be done in the eastern or central section,—whether there was any talk about making any brick arch in those sections or not?

A. Oh, there was plenty of talk, prior to the execution of the contract, in regard to brick arching, &c., but the information which we received from the engineers, in regard to the arching of the Tunnel, was precisely the same as is to be seen in Mr. Latrobe's published report,—that it would be limited to 1,271 feet, in the western division. That was spoken of at the time, distinctly; it is on public record.

Q. These specifications say that no apprehension was felt from slides or falls, as the rock was sufficiently hard to support itself, do they not?

A. Yes, and that was distinctly stated in Mr. Latrobe's reports. The information that we received from Mr. Frost and Mr. Latrobe tallied exactly with their published reports.

Q. You spoke about this letter of Lieut.-Governor Talbot's, of the 21st November, 1873, in which he stated that on the 1st November, 1873, there still remained to be excavated, at the Hoosac Tunnel, 36,303 cubic yards of rock. I understand you to say that that amount remaining to be excavated does not include any excavation to allow for brick arching in the east or central section; is that so?

A. It does not.

Q. I yesterday laid before the Committee the estimates which were made by Mr. Frost, and reported year after year, from the



time of your making this contract until the present, showing the amount of work required to be done in cubic yards ; you are familiar with those estimates, are you not ?

A. Yes.

Q. I want to know whether any of those estimated amounts of work, required to be done under your contract, included any excavation sufficient to allow of brick arching in either the eastern or the central sections ?

A. No, they did not. Those reports of Mr. Frost, to which you refer, have, every one of them, reference to that schedule which I have just laid before the Committee, which was made up between Mr. Frost and myself as the basis of the bulk sum contract.

Q. Won't you explain to the Committee, a little more in detail, the circumstances under which the brick arch was completed, as then supposed, in the summer of 1872, and the brickyard of the Commonwealth taken back from you ?

A. The brick arch, as now in the west end section, was completed in accordance with the drawings given us some time in August, 1872 ; I think possibly in July. Shortly afterwards, Mr. Frost applied to us to know if we would give up the brickyard, as they had an opportunity then of leasing it to a brickmaker in Adams. We of course agreed to that, stipulating that any brick we wanted we should have at a certain fixed price, because we were constantly using brick for various purposes—boiler-setting, and various other things. We made very little discussion or correspondence about it, but gave up the brickyard without hesitation, as a matter of course.

Q. On what terms did you get the brickyard ?

A. We got the brickyard and the machinery from the State on what is called a royalty ; we paid twenty-five cents per thousand of brick to the State for all the brick we made.

Q. You speak, in your petition, of there having been some special ceremony at the time of the completion of the brick arch ; will you state what occurred ?

A. I remember there was a little "festival." Mr. Frost put in the last brick with his own hand, and there was a good deal of rejoicing that the work was done at last, because it had always been considered a very difficult and dangerous part of the work of the Tunnel.

Q. Was it considered, at that time, that the brick arching of the Tunnel was completed westerly ?

A. It was so considered, evidently.

Q. Did you receive the letter of Mr. Frost, dated July 19, 1873, in which he calls on you to do 344 feet of arching at the west end section and 40 feet at the east end, saying that that is the amount

which will be required to complete the arching of the Tunnel under your contract?

A. Yes, sir.

Mr. ALLEN.—In that letter he speaks of 4,500,000 brick as the amount that would be required to complete the arching of the Tunnel under Mr. Shanly's contract, showing his estimate of it.

Q. Have profiles and plans for the sections of the Tunnel that you were to build been furnished you from time to time by the engineers?

A. They were in the habit of giving us monthly diagrams of the work we had done. [Form of diagram shown.]

Q. What directions in regard to the lines and grades of the Tunnel have you received from time to time from the engineers?

A. They gave the levels and the lines to our foreman every week constantly. The assistant engineer was on the spot to give the lines and grades.

Q. In what form is that done?

A. They put a mark on each side of the Tunnel, every twenty-five feet, which marks have reference to the bottom and top level, and the workmen work from them.

Q. Do these marks show the proper position for the top, the sides and the bottom of the Tunnel?

A. The workmen from these marks can obtain the height,—the height is a fixed point. The workmen from these marks can make the Tunnel to the proper size all round.

Q. That is to say, a mark is made which is so many feet?

A. There is a mark on the wall on each side of the Tunnel, which is four feet above the bottom. The miners know that the bottom is to be taken out four feet below that, and the excavation carried to a certain height above that; and then, if there is any projection which requires to be trimmed off, the engineers pass through and mark it with white paint. That is the way they keep us right.

Q. You set forth in your application which is now under consideration, certain statements in regard to your receipts and disbursements in connection with the Tunnel. I wish you would make such statements to the Committee as you are willing to make on that subject.

A. If the Committee want to know about that, I have no objection to doing so.

Mr. ALLEN.—I think a great many people have the impression that you are likely to go out of this contract with pretty large profits, and it seems to me desirable that the facts should be stated as fully as you are willing to state them.

The CHAIRMAN.—The Committee are of opinion that they do not care to go into that inquiry at all.

Mr. ALLEN.—I suppose the Committee would be glad to know about it. Of course so far as the legal construction of the contract is concerned, as a court of law would not listen to such a consideration for a moment, I suppose it would not affect the legal construction of the contract, and Mr. Shanly, like most business men, is not desirous of parading his private affairs before the public. However, I knew that some members of the legislature, and others, have entertained the opinion that he was making money and that he would go out of this contract with a profit, and it seemed to me that if this contract was so phrased that it was susceptible of more than one construction, and as it appears here that one construction is put upon it by the officers of the State and another by him, it must be taken to be a contract which is susceptible of more than one construction, in that sense that the parties have put two constructions upon it,—if it should appear that even in doing the work which he considered himself that he ought to do, under the contract, he would still come out a loser (which is the fact according to his figures), without doing the work which the officers of the State think he is obliged to do, under the terms of his contract, I thought that was a consideration which it was desirable to lay before the legislature, so that they would know it. I ought to say, in justice to Mr. Shanly, that he consented to make such a statement after considerable urging from me, and that was because I knew that the impression prevailed that he was going to make money under the contract, whereas when he came to state the figures to me, it appeared that he was certainly going to lose money under it, even on his construction.

The CHAIRMAN.—It seems to the Committee that whether he is making money or losing money by reason of this contract, it is not a consideration which ought to influence them in acting upon his memorial. It is put upon another ground.

Mr. TRAIN.—There are two or three memorials, Mr. Chairman; when you say the “memorial,” I suppose you refer to the last one.

The CHAIRMAN.—This memorial embodies the other, or refers to it. I suppose the question whether any relief should be granted under the petition which was first filed would depend mainly upon the question whether the State are secure of the performance of this contract, as it may be determined to be, with granting this relief, and that does not seem to be a question which is to be affected or influenced particularly by the question whether he is making or losing money.

Mr. ALLEN.—Mr. Shanly says he does not wish to press that



upon the Committee at all. He desires that the Committee should understand that this is not proving a profitable contract to him.

No further questions occur to me that I wish to put to Mr. Shanly.

*Cross-Examination.*

By Mr. TRAIN.—Did you have a legal adviser here at the time you made this contract?

A. I did.

Q. Who?

A. Mr. E. H. Derby.

Q. Were you familiar with the Act under which the contract was drawn?

A. Not very familiar.

Q. You read it?

A. Oh, I presume I read it.

Q. You understood what the statute intended to accomplish.

A. Well, I really forget what the Act says.

Q. I do not ask now what the statute was, but only whether you understood at the time you were making this contract, what the statute of 1868 intended to accomplish, and whether you acted under the advice of Mr. Derby in making your contract.

A. I did.

Q. You say you got this specification which you have shown us, at North Adams, of the engineer.

A. Yes.

Q. How long was it after you made these specific item estimates, before you were informed that the contract must be a "lump contract," as you call it?

A. The original proposition was made, I think, in the latter days of August, or the early days of September, 1868; the contract was not made until the latter part of December.

Q. When you came to Boston, at the request of Mr. Wentworth, were you then informed that the contract was to be an entire contract?

A. Oh, no.

Q. How long after that were you informed of that fact?

A. It was when we came to discuss the details of the contract in the council chamber. The discussion opened upon that very bid,—the "item" proposition,—and it was suggested by some one, I don't remember who particularly, that it had better be put into a bulk sum.

Q. Was it not stated that the statute required that it should be an entire contract?

A. I don't remember that; I did not discuss the statute much.

Q. No; but was not that the reason why you were required to make up your estimate as a total sum; that the statute required such a contract to be made? Were you not told so?

A. I don't recall that. It may have been so; but I don't recall it at all.

Q. Do you mean to say, that up to that time you expected your contract would be made for specific portions of the work, as enumerated in these specifications?

A. There was no other supposition I could entertain. That was the proposal I was asked to make; and I made it.

Q. Was there any other form of a contract brought to your attention than the one which you subsequently signed?

A. There was none brought to our attention at all except the one that was drafted when it was determined to make it a bulk sum contract. Mr. Latrobe, the consulting engineer, who, I believe, is also a lawyer, was requested to draft a contract, which, in a day or two afterwards, he produced, and read to the council.

Q. Was that printed?

A. It was not. The council objected to the contract, as I would also have done. It was a very long document. They objected to it; and thereupon they requested Mr. Tappan Wentworth, of Lowell, who was then the chairman of the commissioners, to draft a contract, and make it on the bulk sum principle. That contract, which we have now before us, was roughly drafted by Mr. Tappan Wentworth.

Q. Was Mr. Wentworth's draft printed?

A. I suppose so. I know there were several drafts; every day rough-printed copies came up, which were corrected and interlined, and sent back to the printer. I suppose that Mr. Wentworth's original draft was printed, with some amendments suggested by the legal gentlemen present. I knew there were several drafts printed before they settled down upon the contract which was executed.

Q. Did you see those corrections before they were made?

A. Oh, yes. We were in the council chamber all the time, and my lawyer, Mr. Derby, discussed the points, and I did so myself.

Q. How many days were you occupied in that sort of work?

A. I think I must have been, on and off, in that council chamber for two weeks. I know we completed the contract and signed it on the 24th December; and, if my memory serves me right, we were engaged upon it from the 10th December. We were nearly two weeks (not every day, but at intervals, one day and another,) in discussing the contract.

Q. You were familiar with all the changes that were made from day to day, until the final form of the contract was agreed upon?

A. I was thoroughly familiar with them ; kept up with them all.

Q. Now, do you mean to say, that after you had sat there two weeks, while this contract was being put into form, you did not understand that you had entered into a contract for the completion of the entire Tunnel?

A. I understood this only : I understood that I entered into a contract to do what that contract specifies ; what the specifications call for which are attached to that contract. That is what I agreed to do, and what I stand ready to do, whatever it may cost me.

Q. Now, with regard to these 1,800 feet of arching of which you speak ; you have not been required yet to arch that 1,800 feet, have you?

A. I have not been required to arch it. I have got instructions to excavate for arching.

Q. What instructions have you had ; to proceed how?

A. By cutting out the excavation to a size to admit of a brick arch being put in.

Q. Through the whole 1,800 feet.

A. I so understand it.

Q. I never had so understood it. I supposed that the difference arose between us upon the general proposition, that you were to do whatever arching might be required in the Tunnel, and wherever it might be. You assume that you are to arch 1,800 feet?

A. If ten feet would require arching there, 1,800 feet would.

Q. Does it follow?

A. It does follow.

Q. Is that your opinion as an engineer?

A. That is my opinion, and it is the opinion of Mr. Frost also ; we have talked it over. It may not be exactly 1,800 feet, but thereabouts.

Q. You say it is not slate, but wet granite?

A. It is not slate, but a sort of wet granite.

Q. Is it wet granite?

A. I call it so. Geologists may give it a different name. It is not mica slate. I don't know what geologists would call it. I don't call myself a first-class geologist.

Q. Now, I want to call your attention to a part of the examination by the Chairman. I did not quite get the question or the answer. Will you have the kindness to repeat what you said?

A. The question was, when we commenced to drive the heading west of the central shaft, and he took it for granted that we worked on the top of the Tunnel. I explained that it was not the top, but the middle of the Tunnel. We followed up the enlargement, working both ways, and are to-day working both ways.



Q. At first, did not the men work on the upper side of the Tunnel?

A. For the first 350 feet, until we struck water, and then we enlarged that place to the full size. That was while we were in dry rock.

Q. That was very disadvantageous work, was it not, that was done upon the top of the Tunnel?

A. It was not disadvantageous, because it was good rock, dry rock.

Q. Well, I understood you (I probably misunderstood you) that you were driven from that by the water?

A. It was perfectly dry for 350 feet; very good work, excellent work. As soon as we struck the granite, it became disadvantageous work; the water drove us out as soon as we struck the wet granite.

The CHAIRMAN.—I desire, Mr. Attorney, to indicate the purpose of my inquiry so that you may see exactly what it was. It was this: It seemed to me, and it has been claimed here, that this work was proceeding with the knowledge of the state engineers, and was proceeding in a manner not fitted for arching, and what I was undertaking to find out was, how much progress was made in that work, in a manner not fit for arching with the knowledge of the engineers, and with no protest against it. That was the entire purpose of my inquiry, if there is anything which you would like to develop in reference to that.

Mr. TRAIN.—I misapprehended the inquiry and did not understand the answer of Mr. Shanly.

Q. Now, how much did you say, in answer to the question of the Chairman, was done by you in that way, without interference on the part of the engineer and with his knowledge?

A. Well, as I suppose, as I told the Chairman, in answer to his inquiry, that there may have been five or six hundred feet undone at the time Mr. Frost came to see me about arching. I won't say within a few feet or so.

Q. Of the whole 1,800 feet, there may have been five or six hundred feet remaining to be done?

A. I think likely.

Q. Do I understand you to say that you never understood you were to do any arching in the east section?

A. I do. You understood me correctly there.

Q. At the time the brickyard was taken away from you, you had not got into the central section, where these 1,800 feet are, had you?

A. No, we had not got far in, we had got as far perhaps as fifty or sixty feet.

Q. I do not understand that any portion of this work was developed until last October?

A. Oh, yes, we joined our headings last November. We started anew in the end of December, 1872, and made the greatest continuous progress we ever made, and never stopped an hour until we got through, in November last; we worked through that rock without check or interruption from December, 1872, until November last?

Q. I wish you would restate how that was?

A. It was just as I stated it to the Chairman. After we struck that wet rock, we may have worked fifty or sixty feet, when we found it necessary to abandon it, and it stood abandoned until we got an opening in the east end, in December, 1872. This gave us drainage. Then we immediately started in the western heading, and we never stopped work until we joined the headings, on the 29th November last. We worked right along, and made great progress every month we were in that rock. We worked eleven months continuously without check.

Q. When did you begin to work against the true roof of the Tunnel?

A. I can't tell exactly when we began, without referring to my sections and drawing in the office.

Q. Was it not in October last?

A. Oh, no, we began long before that; months before October. I forget exactly when we began to construct the true roof, but long before October.

Q. How much of your own time have you devoted to this enterprise at the Tunnel itself?

A. I can't tell you exactly.

Q. What portion of the time have you been at the Tunnel?

A. The whole of my time, I might say; I have scarcely been anywhere else. North Adams has been my residence for five years.

Q. You have been a member of the Canadian parliament, a candidate for parliament, and attended to those duties, have you not?

A. I have.

Q. And have been absent from the Tunnel a great deal?

A. Not much; very little.

Q. Well, how much?

A. I can't possibly tell without referring to my diaries.

Q. Can't you give us an idea about it? Haven't you been away weeks at a time?

A. I have been away probably three or four weeks at a time.

Q. Haven't you been away months at a time?

A. No, never.

Q. Has not the work been done largely under the control of your foreman, and not under your own immediate supervision?

A. Nothing has been done except under my direction. There wasn't a foreman on the ground who did not go by my orders from day to day.

Q. If you were not there, you couldn't give them orders from day to day, could you?

A. Yes, I could communicate with them without being there. There are telegraph wires and post-offices these days, and my directions have been carried out to the letter. I do not say that I have been in the Tunnel night and day, like the foremen, but even the foremen have to change occasionally, on and off. I would like to have you or anybody else show me the square inch of that Tunnel I do not know.

Q. I understood you to say, Mr. Shanly, at the last hearing, that if you were required to do this work, you must stop, you could not do it?

A. That is just about my position.

Q. Is it your position or not?

A. That is my position exactly.

Q. What do you mean by that—that you are not able to perform your contract, or won't perform it?

A. Yes, I hold that I am able to perform my contract, but not to \$300,000 worth of work outside of my contract.

Q. Suppose it is determined this work should be done by you, under your contract, do you intend to do it or not?

A. No, I cannot, because I have not got any money to do it with. That is the precise state of the case. I cannot do it.

Q. I understood you to say, at the last hearing, that you knew two years ago, that more arching would be necessary than you understand the contract to call for; was that so?

A. I told you just now that I knew every square inch of that Tunnel, and of course I knew that fact.

Q. Did you tell anybody of it?

A. I don't remember talking about it at all; I may have done so.

Q. What brought the fact to your attention?

A. The character of the rock.

Q. Was the character of the rock where arching is required developed three years ago?

A. It was developed the day we struck water. I knew that as long as that rock lasted,—I couldn't tell how long it would last,—but I knew that as long as it did last, the Tunnel through it would require arching.



Q. Do you mean to say that wherever you have water, arching is required?

A. No, but where we find water in that broken granite, as long as that bad rock continued, arching would be required.

Q. That was in the western section?

A. No, sir; you have not got the geography of the Tunnel right in your mind. When we say "west" we do not mean the west end section, but the west side of the central shaft. There is the east section, the central section and the west section of the Tunnel. The central shaft divides the central section into east and west, and it was on the western side of the central section that we met the trouble, not in the "western section" of the Tunnel, so called.

Q. Do I understand you to say, that this matter of enlarging the Tunnel for the purpose of arching imposes very great additional expense upon you?

A. Of course it would. It requires us to remove ten additional yards of rock per lineal foot of Tunnel.

Q. Did you not say the other day, in the council chamber, that as far as the expense of making the excavation was concerned, you would just as soon make it small at first and enlarge it afterwards?

A. As things are now, I would. We are bound to finish the Tunnel by the first day of September next. If we were to set to work to make that arching now, we could not do it. As matters stand to-day, I should much prefer to take it the other way. It is physically impossible to complete the work by the time fixed, if this arching is to be done. It is quite impossible to get the brick to do the arching, let alone taking out the rock at the bottom, within the time limit of our contract. It not only puts us to an additional expense of \$300,000, but it makes it physically impossible for us to do the work within the time fixed. If any engineer tells me that he can get five millions of brick between the 7th of January and the 1st of September, I challenge him to show me how he can do it in the State of Massachusetts. It cannot be done. It is simply a physical impossibility.

Mr. ALLEN.—In reference to the question that was asked Mr. Shanly, as to when he thought arching would be necessary. I suppose it is in the minds of the Committee, that Mr. Laurie, in his report, made February 3, 1870, to the governor and council, to which I called attention yesterday, having referred to the east section, where it was already apparent that arching would be necessary, expressed the opinion that "more arching would be necessary near the anti-clinical axis of the stratification," which would be in the central section of the Tunnel. That report is published in that document to which I called your attention (Senate Doc., No. 283,

for 1871). Mr. Laurie was then consulting engineer of the Commonwealth. Mr. Philbrick is his successor.

I do not think of anything further that I wish, on behalf of Mr. Shanly, to lay before the Committee.

#### OPENING ARGUMENT OF ATTORNEY-GENERAL TRAIN.

*Mr. Chairman and Gentlemen:—*

I hardly know whether to make a formal opening or not. I desire to call two or three gentlemen who were in the executive department at the time the contract was made which you have under consideration, some of whom are here, but one of whom, the lieutenant-governor, I regret to say, is not here, and I may be compelled to delay for a day or two until he returns. But perhaps there will be no impropriety in my stating the views which I am to represent here, even if I should be obliged hereafter to re-state them, which I hope, however, I may be able to avoid.

It is a disagreeable duty, always, to resist applications like this, especially when placed upon the grounds outside of legal grounds which are suggested here, and the party who represents the Commonwealth is under a very great disadvantage.

The Commonwealth is a legal abstraction; it is a sort of myth, and is the poorest kind of a client that a lawyer can have; certainly as far as aiding and instructing him in making an investigation. "What is everybody's business is nobody's business," and it is with the greatest difficulty that the parties who represent the State in a case like this can ascertain the facts which are requisite to a proper inquiry, put them into proper shape, and develop them systematically as they ought to be developed before a Committee of this sort.

My own attention to this subject was first attracted some time last autumn, when the correspondence, the orders in council, and other papers which I have handed to the Committee, were placed in my hands, and I was desired to give an opinion as to the character of the contract which the State had made with the Shanlys. Of course, I gave it the careful consideration which the magnitude of the interests involved required. I came to the conclusion, at which I arrived after what I believed was the fullest investigation, upon the adoption of sound principles of construction, and upon a full knowledge of the legislation upon which the contract was based, and I am free to say, that I have seen no occasion to change the opinion which I gave. I can see none. A more and more thorough investigation and discussion only confirms me in my opinion. I know of no way in which that question can be settled so well

to the satisfaction of everybody within the Commonwealth, as in the way which has been offered to the Messrs. Shanly, to wit: by making a case and submitting it to the supreme judicial court. Now, when they decline that proposal, and come here and ask for favors, I think they ought to be required to elect upon which proposition they will go. I do not think they should come here and say that the contract does not require them to do the work which is claimed of them by the executive; but that if it does they cannot do it, or they won't do it, and, therefore, they ask you for relief. I hold, that no petitioner has a right to put himself before the legislature in any such position.\* Here is a fair question of the construction of this contract in difference between two parties; there is a tribunal by which that question can be definitively settled, and no man has the right to decline to have that question settled before the judicial tribunals of the Commonwealth, and then come here and endeavor to force a bill through the legislature, upon the ground that the view which he takes of that contract is the sound one, and that the view taken by the other contending party is unsound.

The attempt, Mr. Chairman and gentlemen, is this: to get you to report some bill which shall give to the Messrs. Shanly relief from a portion of the responsibilities of their contract, and then to go before the legislature, of which you are members, and undertake to carry that bill by asserting and arguing that the Shanlys are not bound to do the work according to the terms of the contract as the executive department understand it. Now, I am entirely willing, and so is the executive department, to have the legal question settled by itself, and it ought to be settled by itself, for the reason that the legislature should not be embarrassed by a doubt which could be first disposed of by the supreme judicial court of the Commonwealth. If the supreme judicial court shall say that the Shanlys are not bound by their contract to do this work, the Shanlys have no occasion to ask you for any aid or relief, either in the way of giving up the \$200,000 worth of bonds, or by granting them additional compensation. If they are relieved of that burden, they ask no favors, they claim no favors, they are abundantly able to perform their contract, they intend to perform it, and expect to make money by it. Now, why should they be allowed to smuggle a controverted question of law into this discussion for the purpose of aiding them in getting a bill, which is essentially a bill for their relief, through the legislature?

This is the unfairness of the proposition which is submitted here by my learned friend who appears for the other side, and I am compelled to argue the legal proposition; and however satisfactorily it might be developed to you, it will still not have the force of a judi-



cial decision; and if you report that the legal proposition was entirely in favor of the Commonwealth, you will find these gentlemen going through the legislature, and through every boarding-house and hotel where a legislator can be found, arguing the legal proposition as though it were an open question.

But with these general suggestions as to the way the case lies in my mind, I must call your attention to the legal question, and, having done that, I shall do what I think the case did not require, and does not require,—call some testimony outside of the contract, for the purpose of showing how it was regarded, and how the parties behaved at the time it was executed.

In construing this contract, the same rules, I take it, are to be applied between the Commonwealth and the Shanlys that would be applied as between A and B, private individuals, who had entered into any business contract. One thing is very clear at the outset; and that is, that the legislature of 1868, when they authorized this contract, authorized but *one* contract, and they authorized a contract which was for nothing else, and could be for nothing else, than the completion of the Tunnel, entirely and thoroughly. I beg leave to call your attention for a moment to the language of the Act. The 333d chapter of the Acts of 1868 provides “for the further prosecution and completion of the Troy and Greenfield Railroad and the Hoosac Tunnel,” and, without reading the whole of it, Mr. Chairman, I want to read the last three provisos:—

“And *provided, further*, that after the first day of October next, no part of this appropriation shall be used in payment of work done in excavating the tunnel, unless the same be done under contracts approved by the governor and council; and they are hereby authorized to contract for the whole work of constructing the Hoosac Tunnel: *provided*, that a contract, with satisfactory guarantees, can be made for the completion of the same within a period of seven years and at a cost not exceeding five millions of dollars: and *further provided*, that in case a contract should be made by the governor and council for the completion of the tunnel, there shall be withheld from payment under said contract, a sum not less than one million dollars until the final completion of said work, and the acceptance of the same by the governor and council.”

Now, perhaps, upon some construction, the whole work might have been provided for in separate contracts, but it is very clear that the executive department, acting with the best legal lights and the best experience which they had in making this contract, decided that the whole work was to be provided for in one contract, and having decided that it should be done in one contract, that contract, and the only contract they were authorized to make, is a contract

*for the completion of the Tunnel.* It is to be made in one contract, and they have but two limitations, to wit: the amount to be paid, and the time within which the contract is to be completed. Now, that is the authority which the legislature had vested in the executive department. They had no power to make any other contract; and if they made any other contract, it was, and is, and has been ever since it was executed, unauthorized, and everything done under it has been unauthorized. The law of the Commonwealth affected the Shanlys, as it did every other citizen of the Commonwealth; it entered into the contemplation of the Shanlys, as it did into the contemplation of the executive department, when the contract was about to be made, and Mr. Shanly tells you himself that he knew the provisions of the statute, and he tells you that he had as his legal adviser Mr. E. H. Derby, than whom there is no more astute lawyer, in the arrangement and preparation of contracts like this, in the Commonwealth. Now it is claimed that, because the governor and council distributed specifications of items, and subsequently made what Mr. Shanly chooses to call a "lump contract," this contract is to be treated as though it was an "item contract," or, at any rate, that if the work is not found specified in the items enumerated in the paper which he produced here before you, he is not bound to perform it. Well, I submit, on the contrary, that the contract is susceptible of an interpretation by itself, that there is no ambiguity in regard to it, and I shall undertake to prove, in addition to that, that it was perfectly understood by the Shanlys, and by everybody else, that, whatever change might arise, this contract was a contract for the completion of the entire work, and that the risks of these changes were on the part of the contractors, and that the Commonwealth bore none of them whatever.

My friend on the other side yesterday called your attention to some rules of construction, very properly, and I propose to call your attention to the same rules, and then to apply them to this contract. My friend read an extract from Paley yesterday, which is found in "Chitty on Contracts." I wish he had read more of it, because I think the doctrine is well stated; only he did not read enough of what is stated by the text-writer, so that I want to read a little more. This is what it states:—

"When the terms of the promise admit of more senses than one, the promise is to be performed in that sense in which the promisor apprehended at the time that the promisee received it. It is not the sense in which the promisor actually intended it that always governs the interpretation of an equivocal promise, because at that rate you might excite expectations which you never meant, nor would be obliged to satisfy. Much less is it the sense in which the promisee actually received the

promise, for according to that rule you might be drawn into engagements which you never designed to undertake. It must therefore be the sense, for there is no other remaining, in which the promiser believed that the promisee accepted the promise."

Mr. ALLEN.—I read that.

Mr. TRAIN.—I beg your pardon then. I did not understand you to do so. Now, what I am to claim and what I shall claim under that principle of construction is, that both these parties (for they were both promisors and both promisees), the Commonwealth and the Shanlys, understood that this was a contract for the entire completion of the Tunnel, no matter where it went and no matter what the contingencies were which arose, and that there was no chance of having any conflict of opinion about that.

There is one other principle, Mr. Chairman, which I wish to invoke, and that is this: "The situation and true intent of all parties and the subject-matter are to be considered in determining the meaning of a contract." I need not state the authorities on that, the books are full of them, and the Chairman is perfectly familiar, and so, I suppose, is everybody else, with the general doctrine. "So in considering a contract the court will look to the motives that led to it and the object intended to be effected by it."

Now, with these principles of construction, let us devote a few moments to the contract itself. I wish the Committee and everybody else, in considering this question, not to forget that the Commonwealth had been at work ever since 1856, perhaps—I don't remember the precise date—from the time they had begun to advance money, from the time they made the arrangement with the Troy and Greenfield Railroad, they and everybody else, from the the time the charter had been first granted, in 1848, had been trying to cut through the Hoosac Mountain. It had been a subject which had attracted the attention of the whole people of the Commonwealth and the country. It had entered into the politics of the Commonwealth; people had ranged themselves on one side and the other on the question, and a time finally came when there must be a grand effort either to complete it, or the project must be abandoned altogether. That time came during the administration of Governor Bullock, and that legislation took place in 1868, and is the chapter to which I have referred. Now, then, everybody in the Commonwealth, and the Shanlys, too, understood that if that job could be finished within seven years, and within five millions of dollars, then it was to be done, and if it could not be done for that and within that time, then it was not to be done at all. There was not a child in the Commonwealth, who was old enough to understand



anything about it, who did not know that was the way the thing was left by the legislature of 1868. So that, when the governor and council began to cast around to see whether that legislation could be carried out by a contract, there was no misunderstanding in the minds of anybody as to what was to be accomplished, if anything, under that legislation. And Mr. Shanly admits, as the law would make him admit, in any event, that he understood the legislation perfectly well.

Now, then, that was the understanding, as evidenced by the specifications which were issued. [Counsel read the opening paragraph of the specifications, and then continued:] This was for the purpose of informing everybody, as well as they could be informed, through the aid of the officers of the State who had been at work on the Tunnel, what had been done and what substantially remained to be done. And if you will look upon the seventh page, Mr. Chairman, of this specification, on which Mr. Shanly made his figures, and on which he says he and Mr. Frost made up the sum-total for which he subsequently agreed to perform the work, you will find this clause: "The formal contracts, when executed, in addition to what is herein specified, may contain all such further suitable and fit provisions as shall fully insure the entire completion of the Tunnel, in all respects, in a thorough and workmanlike manner." Now, what I have to say upon that paper, which came into the possession of Mr. Shanly, and upon which he says he acted, is this: that in addition to the fact that he knew from the statute itself that the contract which the executive sought to make looked to the completion of the Tunnel, it was distinctly and exactly brought to his attention by the specifications on which he says he acted.

The CHAIRMAN.—I understand you to say, that the specifications state that the formal contract might call for something different from what is in the specification itself. That is the substance of it?

Mr. TRAIN.—Yes, sir. It says this, "The formal contract, when executed, in addition to what is herein specified, may contain all such further suitable and fit provisions as shall fully insure the entire completion of the Tunnel in all respects, in a thorough and workmanlike manner." So that, although Mr. Shanly knew he was to respond to these specifications as they were put forward by the engineer, he also knew, when he sat down and began to make his figures, that the contract eventually would or might contain every provision that was necessary to insure the entire completion of the Tunnel. And he knew more than that; he knew it must contain that, because the legislation under which the governor and council were acting did not authorize anything else.

Now, the contract executed by the governor and council, with whom

Mr. Shanly says he and Mr. Derby sat two weeks putting the contract into shape, and knowing all the changes that were made from day to day, provides, on the first page, that "the parties of the first part hereby covenant and agree with the said Commonwealth to do and perform all the work necessary to complete the Hoosac Tunnel with its central shaft (being a portion of the Troy and Greenfield Railroad) in accordance with the schedule hereunto appended." The Hoosac Tunnel is to be completed; it is not to be left half done; but it is to be completed "in accordance with the schedule hereunto appended." We will give that language its entire force before we get through; "and after the completion of the Tunnel" he is "to remove from the Tunnel all materials and other things so as to leave the Tunnel and railroad track in complete order, ready for use, and to the satisfaction of the governor and council of the Commonwealth." The very opening language of the contract looks to the completion of the Tunnel; the specifications on which these people have been invited to make a list of prices contemplate the completion of the Tunnel; and then, in the second clause of the contract are these words: "But no errors in the estimates of the work to be done and the materials to be furnished under this contract shall affect the contract price to be paid for the whole work." Well, now, why was that put in? It was put in because the contract was understood to be an entire contract, and if there were any errors which were in favor of the contractors, the contractors were to have the benefit of them, and they were to have the entire price, whether the work which was enumerated in the schedule annexed was more or less than the schedule called for. That was a provision in favor of the contractors. Now, if I understood the argument, the whole effect of these schedules and the whole reason why they were put in was to enable these parties, upon some basis of calculation which should be made by the engineers, to obtain the proportion of their compensation to which they were entitled or would be entitled under the contract, as they went along.

There must be some guide; it could not be left without any guide for the parties on the one side and the other. They had made an entire contract, or they were about to make an entire contract, and as security for the contract, which was for the completion of the Tunnel, there was to be withheld from payment a sum not less than one million dollars, until its final completion.

Now, in order that the contractors might draw compensation, and that the Commonwealth might preserve its security, these schedules were adopted as guides for the contractors and the officers of the Commonwealth in determining the matter of compensation; and to say that because a piece of the work necessary to the completion of

the Tunnel is not found in the schedule, the contractors are under no obligation to perform that work, is to stultify the language of the contract, which says that the Tunnel is to be fully completed, within the meaning of the act; for the act is made a part of the contract specifically. On the fourth page of the contract, reference is made to the statute of 1868.

The CHAIRMAN.—Where is that?

Mr. TRAIN.—On the fourth page, it says: "And, whereas, it is provided by the statute of 1868, chap. 333, that this contract shall contain satisfactory guarantees for the completion of the whole work herein contracted for, with limitations as to time and cost herein specified"; and it is also provided by the statute of 1868, chap. 350, that this contract shall provide for payments, by instalments, as the work progresses, in such manner that not less than twenty per centum of each amount due shall be reserved for a final payment on the completion of the same." The Act itself, the legislation on which the contract was founded, is thus made a part of the contract, although it must be construed in connection with the contract, I suppose, whether it be referred to or not. Now, then, commencing at the bottom of the fourth page, I read: "And the Commonwealth shall, until the completion of the contract, reserve twenty per cent. of each amount due for work done according to the certificates of the engineer or engineers for a final payment, without any addition for interest, on the completion of the whole work herein contracted for, and its acceptance by the governor and council; and, subject to the above reservations and provisions, the Commonwealth shall pay to the parties of the first part, at Boston, on or before the fifteenth day of each month following the performance of the work, eighty per cent. of the amount of money earned by them, as ascertained and shown by the certificates of the engineer or engineers; and, upon the final completion of the whole work herein contracted for, and its acceptance by the governor and council, and upon the surrender by the parties of the first part to the Commonwealth of all real and personal property of the Commonwealth which the Commonwealth will then be entitled to receive from them under the terms of this contract, and in reasonable and proper condition and manner, and upon the adjustment of all questions growing out of this contract, and the execution and delivery by the parties of the first part of a release of all claims and demands upon the Commonwealth growing out of this contract," then the Commonwealth would pay them such further sum as was due under the contract. Now, then, I come to the sixth page, on which the schedule commences, "Dimensions of the Tunnel." Now, I need not say I agree that nothing is said in relation to brick arching, except in the places pointed out by my friend on the other side.



The schedule undertook to state the work already done, and the work required to be done. It says, "The work to be done is, 1st, enlargement of Tunnel; 2d, enlargement of heading; 3d, extension of full-sized section of Tunnel"; and in that mode it points out what remains to be done, and what had been done, and the mode in which the value of the labor performed by the contracting parties should be estimated in getting at the monthly payments. Then, in the closing part of the contract, some one was wise enough to put in a provision which should favor the Commonwealth, precisely as the provision which I first read favored the contractor; the corresponding one to that, which says, "No errors in the estimate of the work to be done and materials to be furnished under this contract, shall affect the contract price to be paid for the whole work." If the work had been but half as much —

The CHAIRMAN.—Where do you read that?

Mr. TRAIN.—That is on the first page; that is a provision for the benefit of the contractors. It was a very proper one to go in. They were to have a gross sum for this work. If the amount of work remaining to be done had been but half as much as appeared by the schedule, the Messrs. Shanly were entitled to their \$4,400,000 just the same. Now, you want a corresponding provision for the protection of the Commonwealth, and you find it in the very last clause of this contract: "It is understood and agreed, that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule, nor shall the specific details of work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part now under contract to B. N. Farren, to be performed under this contract, nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract." Now, if the clause in the commencement of the contract, to which I have called attention, is a clause for the protection of the contractors, the clause to which I have just called your attention at the close of the contract, is a clause for the protection of the Commonwealth; and it shows, whatever Mr. Shanly may say, that the parties at that time contemplated a contract for the completion of the work; that it was to be done for a specific sum of money; that the whole of it was to be done by the Shanlys, whether it appeared in this schedule or not.

Mr. ALLEN.—What force do you give to these words: "The entire work of the completion of the Tunnel, \* \* \* to be performed under this contract"?

Mr. TRAIN.—I give them the same force as I do the rest of the

language. I don't understand the force of your construction. I suppose you undertake to say it applies to the schedules.

Mr. ALLEN.—I say that it would not relieve them “from the full and complete performance of the entire work of the completion of the Tunnel, to be performed *under this contract.*”

Mr. TRAIN.—Well, what was the “entire work”? The “entire work” was the completion of the Hoosac Tunnel, without reference to the schedules.

Mr. ALLEN.—The “entire work,” as I say, is that mentioned in the first four lines of the contract: “work necessary to complete the Hoosac Tunnel, *in accordance with the schedule hereunto appended.*”

Mr. TRAIN.—I say, the entire work “according to the schedule hereunto appended” means the completion of the Hoosac Tunnel, and that that language is put in there to control the schedule, so as to prevent the very construction which my brother claims now. The governor and council knew they were authorized to make a contract to complete the Tunnel, and nothing else. They were not authorized to make a contract for work to be done within five or seven years that would not complete the Tunnel. The legislature said to them, “You shall not do it, unless the work can be accomplished in its entirety. If you can get the contract within those limits, then you are at liberty to do it; otherwise, you are not at liberty to do so.”

The CHAIRMAN.—I do not quite appreciate the force you give to the words (if you give them any force), “in accordance with the schedule hereunto appended.” Why not leave out those words, if the contract was to construct and complete the Hoosac Tunnel?

Mr. TRAIN.—I think you might leave them out.

The CHAIRMAN.—But is it not necessary, in the construction of a contract, to give more effect to all the words in it, if you can?

Mr. TRAIN.—Yes, sir; but it is perfectly apparent to my mind that the use which was to be made of the schedule was the use which I have indicated. So far, that language has a usefulness; but it would be a very rash construction, as it seems to me, to say that the words, “in accordance with the schedule hereunto appended,” shall override and control both the provisions on the first and last pages, one of which is in favor of the contractor, and the other in favor of the Commonwealth. If the construction which my brother Allen claims for those words, and which is indicated by the Chairman in his question, is to govern, then you must throw out the two clauses to which I have called attention.

The CHAIRMAN.—Why, necessarily so? “But no errors in the estimates of the work to be done,” not *of the work to be done*, but

“in the *estimates* of the work to be done,” “and materials to be furnished under this contract, shall affect the contract price to be paid for the whole work.” Now, if you have got an estimate here of the number of yards of excavation, and it shall turn out that there are more yards or less yards of excavation, the pay is to be the same.

Mr. TRAIN.—Yes, sir.

The CHAIRMAN.—Suppose it turns out that there is something to be done to complete the Tunnel, as is now claimed by you, which is not specified in the schedule? That is my difficulty in the matter.

Mr. TRAIN.—That is controlled by the last clause on the last page.

The CHAIRMAN.—“It is understood and agreed, that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule.” That is *quantities*.

Mr. TRAIN.—Or anything else—“etc.”

The CHAIRMAN.—“Nor shall the specific details of the work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part now under contract to B. N. Farren, *to be performed under this contract*.”

Mr. ALLEN.—That is it, exactly.

Mr. FULLER.—Is that “etc.” in the original contract?

Mr. TRAIN.—I suppose so. This purports to be a copy.

Mr. ALLEN.—It is rather overworking the “etc.” to give it so much force as that.

Mr. FULLER.—It should have some force, as it is there.

The CHAIRMAN.—“It is understood and agreed that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule.” “Correctness of the estimates.” That is what that means. If they are wrong, the Commonwealth will not be responsible for them. “Nor shall the specific details of work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, \* \* \* to be performed under this contract.” If they had left out the words, “to be performed under this contract,” there would have seemed to be stronger ground for the construction which you put upon it.

Mr. TRAIN.—They were not performing any work under any other contract.

The CHAIRMAN. It comes right back to the question, does it not,



“What *is* the work to be performed under this contract?” Is it not the work “in accordance with the schedule hereunto appended”? I call your attention to that, Mr. Train, for the purpose of having you throw such light on it as you can.

Mr. TRAIN.—I have considered it as well as I can.

The CHAIRMAN.—I have no doubt you have, but I wanted to call your attention to what is laboring in my mind. If you can relieve it, I should be very glad to have you.

Mr. TRAIN.—I do not see how, in the light of the statute, and of the power vested in the executive, it could have entered into the mind of anybody that he was going to make a contract for anything else than the completion of the entire work.

The CHAIRMAN.—Suppose that the statute had been more specific than it is, and had restricted the executive in making the contract more than it does, and the executive had proceeded to make a contract that they had no authority to make at all,—suppose that the contract is void, because nobody had authority to make it, upon the question of the construction of the contract, would the statute, except so far as it might throw light upon the intention of the parties, affect the contract itself?

Mr. TRAIN.—No, sir; I do not think it would. I do not claim anything more than that. I say that they undertook to contract under that statute, and that, undertaking to do that, we understand from that what their intention was; and if there is any doubt about it, the intention must govern; and that the intention was, on the part of both sides, to complete the Tunnel, is evidenced by the fact, that the knowledge is brought home to Mr. Shanly by the Act, by the specifications, and by the contract which he subsequently signed,

Mr. SLEEPER.—Did I understand you to state, that you thought the schedule was included in the contract in order to determine the amount to be paid from time to time, under the contract, to the contractors?

Mr. TRAIN.—Yes, sir, exactly.

Mr. SLEEPER.—If that was the case, why were the provisions on the 3d and 4th pages necessary? Were they not put in for that specific purpose, to determine the amounts to be paid? They are not in the schedule, they are in the contract.

Mr. TRAIN.—I take it they were put in for the purpose of determining the amounts to be paid the contractor.

Mr. SLEEPER.—But these are not in the schedule.

Mr. TRAIN.—I don't know that I understand your question.

Mr. SLEEPER.—I understood you to say that these specifications were put into the schedule for the purpose of determining the amount to be paid from time to time.

Mr. ADAMS.—You (Mr. Sleeper) are speaking now of a part of the contract?

Mr. SLEEPER.—I understood him to say that this schedule of work to be done was put in for that purpose.

Mr. TRAIN.—My idea is, that this schedule was put in by way of information as to what had been done, and was to be done, and that it is controlled by the general language at the end of the contract. That is all I claim for it.

Now, with these suggestions,—I find it is one o'clock, and of course the Committee want to adjourn directly,—with these suggestions as to the construction I give to the contract, I will at the next hearing call two or three gentlemen, and show what entered into their minds in making the contract.

Adjourned to Wednesday morning, 25th February.

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WEDNESDAY, February 25, 1874.

The Committee met at 11.30, A.M.

Mr. TRAIN.—Before putting in any evidence, Mr. Chairman, I want to add a few words to what I said the other day, hoping that by so doing I may be able to shorten this hearing, and perhaps save any further occupation of the time of the Committee. I have had considerable labor, and spent much time in this investigation, hunting up the evidence of what was done at the time this contract was prepared in the executive department. The Committee will remember that Mr. Shanly stated that he was present with the council, with Mr. Derby who was his legal adviser, and that considerable time was spent before the contract assumed the shape in which it was finally executed. For the purpose of showing what the intention of the persons and parties concerned in the execution of that contract was, for the purpose of showing that everybody, at that time, contemplated but one contract, and that a contract which should, when completely performed by the Shanlys, effect the entire completion of the Tunnel with a track ready for use to the satisfaction of the governor and council, and that a large proportion of time was spent in arriving at what was believed to be that result, I have been able to obtain the different forms which the contract assumed, during that labor on the part of the council, and Mr. Shanly and his legal adviser. You will remember that Mr. Shanly said, the other day, that a draft was originally written by Mr. Latrobe which was rejected, and that then, he thought, a draft was prepared by Mr.

Wentworth, and from that, or out of that, possibly grew the contract which is now before the Committee.

The CHAIRMAN.—Who drew the first contract?

Mr. TRAIN.—Mr. Latrobe, I understood Mr. Shanly stated. Now, whoever was the author of that first draft, that draft was put into type, then the gentlemen interested in its preparation sat down and criticised it, and after they had criticised awhile and made their written emendations upon the proof it was sent again to the printer, and a new proof was prepared for them, and the same process was gone through with that proof. When they had concluded their emendations on that copy, it was thought the proper time to see it in type again, so it was sent again to the printer, and then a third proof was submitted, and from that proof, with such criticisms and amendments as were suggested by everybody interested in the formation of the contract, the present contract resulted.

Now, the effect of all the evidence which I shall submit is, to show exactly what I claim was accomplished, to wit: that they were all striving to make a contract between the Commonwealth and the Messrs. Shanly, which should provide for the entire completion of the whole work by the Shanlys, throwing all the contingencies upon the Shanlys, for a specific sum to be paid by the Commonwealth, within the time limited by the specifications and by the contract itself. Now, while I have no doubt that I shall succeed in establishing that proposition, by way of aiding in the construction of the contract, following out the line of evidence introduced by Mr. Allen, and tending to show that, whatever the contract may have been, it was not expected at that time that the arching, which we now claim may be required to be done under this contract, *would* ever be needed or required under that contract; seeking by my evidence to accomplish in my direction what Mr. Allen supposes he accomplishes in his direction, by showing that this arching did not enter into the mind of anybody at that time; while I shall have accomplished that, I shall have come to this at the same time,—that I shall concede that this work, which now appears to be required, was not at that time thought of as necessary by the parties upon the one side and the other. We shall not differ upon that proposition, that while on the one side, and on both sides as I claim, we thought we had got a contract which covered everything, at the same time it was not supposed that any arching would be required anywhere but in the west-erly section of the tunnel.

Now, that presents a claim, an equitable claim, on the part of the Shanlys, if the legislature choose to consider it, for additional compensation under the contract, and, if the inquiry took that form, I should not appear, and am not instructed to resist any such applica-



tion, nor does the executive department desire me to resist it. Now, then, Mr. Shanly said the other day, that if the legal construction of the contract was as I claim it, that is to say, if he was to be required to do the arching under this contract which we claim he is bound to perform, he could not do it. I do not use his language, because the Committee will remember his language, and it was accurately reported, I believe, in the "Advertiser" of the next day. Now, then, it is of no use, as it seems to me, for me to spend the time of the Committee, or the time of the legislature, or my own time, to bring them to a result which, when they arrive at, will be of no value to anybody. Because, assuming Mr. Shanly to be a truthful gentleman, if the Committee say he is bound to do that work, or if the legislature should say so, under that contract, why then he says, "I cannot do it, and that's the end of it." Therefore it has seemed to me to be simply a waste of time to pursue the legal branch of this inquiry, and with that suggestion I have sought an interview with counsel on the other side, and I think we agree substantially that the facts may be as I claim them on my side,—and I do not controvert the facts as he has put them in on his side,—and I therefore desire now to suggest that this investigation, so far as it tends to elucidate any legal view of the case, should stop here for the present, for the purpose of ascertaining whether the Shanlys shall receive any equitable relief at the hands of the legislature. When that question is disposed of, if it should be disposed of in such a way as to make it proper or desirable that any legal question should be settled under the contract, that may be disposed of subsequently; but I cannot, with my present views of the inquiry, anticipate that that time will arrive. I believe, Mr. Allen, I have stated substantially the views which we entertain together in relation to this matter; if I have not, correct me, so that I cannot be under any mistake.

MR. SHANLY.—With the permission of the Committee, and yours, Mr. Chairman, I would ask leave to say a very few words, which I am induced to say from what has just fallen from the honorable attorney-general. He has so far met my counsel by admitting that this brickwork was not contemplated in the contract; in fact, in admitting that, he admits that nothing was contemplated that is not embraced in these schedules. That is exactly the position which we have always taken. It appears to me that the admission covers that ground, that the schedules are part of the contract, and that the quantities embraced in those schedules are what we, the Shanlys, undertook to do for the State. Our position—if, as Mr. Train says, at the time the contract was made it was intended that everything in the way of contingency should be covered—is this: that no matter what those schedules say, if three million dollars' worth more of

work has to be done in that Tunnel, we have to do it. Now, I am quite certain that every principle of justice will suggest to the minds of the Committee that that would be what is called a one-sided contract. The State, as the parties of the second part, were sure to get their four millions and a half out of us, and they might get three millions more out of us according to this view of the contract, but we, the Shanlys, could not get so much as three cents more out of the State. That is precisely the position which the Shanlys were in; they were liable for three millions more, possibly, and the State was not liable to them for three cents. I do not think, gentlemen, in this State of justice and law, a one-sided contract—and that would be essentially a one-sided contract—was intended, and I do not believe that it entered into the minds of Governor Bullock and the council of that day to make any such one-sided contract. The discussion of that contract took place fairly and openly, and as I have already stated, I repeat now—and I think those who know me will give me the character of being truthful, which Mr. Train has been good enough to attribute to me—I say that Governor Bullock and his council believed in that day that they were providing in those schedules for everything that was necessary to complete that Tunnel. They believed it the same as we believed it; and in making that contract, they undoubtedly supposed they were providing for the Tunnel, and were to pay us for doing that work, and no further or other work. Mr. Train has also allowed—I don't know that I understood him completely—that he would be willing to grant us such a measure of relief as would pay us for this brickwork. Now, to us, there is no object in doing that work; and I want it to be thoroughly understood that it is a great object to us, a very great object to us, to be enabled to complete our work in that Tunnel within the time limited, and go away, for this reason—and I assert it now plainly—that we, Shanlys, go out of that Tunnel poorer men than we went in. We are therefore desirous of getting away from that Tunnel, and the measure of relief that I ask here is a measure that will exonerate us from doing this work; and I will tell this Committee that it can be done just as well, and as cheaply, by others as by us. If the governor and council were to call for papers for doing that brickwork, and take in bids, they would get plenty of tenders, and get it done just as well as we could do it. Therefore, Mr. Chairman and gentlemen, the measure of relief we look for is, to be exonerated from doing that work altogether; and that, we claim, is what in justice ought to be conceded to us by the legislature of Massachusetts.

The CHAIRMAN.—I understand that the position in which Mr. Train states the case this morning, and which he says is the result

of a conference with the counsel for the petitioner, is this: that he is prepared to show the various drafts of the contracts which finally, by alterations and amendments, resulted in the contract which is now before us; and to argue from that that it was the intention of all the parties that the Tunnel should be entirely completed, all the work done necessary to be done in it, and a track laid, under that contract. Mr. Shanly does not deny, as I suppose from what he has said, that that is one of the results of the conference between counsel, and Mr. Train does not deny that it was not contemplated originally that this work would be necessary. Now, what I want to know is, whether the counsel upon both sides are satisfied that the Committee should deal with this subject, ignoring entirely the legal question involved, and putting it upon the naked question of relief. That is the result of the conference, as I understood it from Mr. Train, but I don't know that I understood it aright.

MR. ALLEN.—I have not got quite so far as that. I do not think there is any difference, nor, so far as I am informed, will any appear, if the witnesses are called, in the recollection of what actually took place when this contract was made. I suppose it would be conceded by every person who would be called, either on the one side or the other, in the first place, that it was not at that time understood or expected by anybody that any brick arching would be required in the construction of this Tunnel outside of the west end section. I have supposed that it would also appear that it was understood, on both sides, that the specifications which were contained in this contract were sufficient to cover all of the work which it was necessary to do to complete the Tunnel. Now when we come down to the bare, simple statement of facts, I suppose that these two statements will cover all the facts there are: it was supposed that there was enough specified in this contract to cover the completion of the Tunnel, and it was not supposed that any brick arching would be necessary, and therefore no brick arching was specified, except in the west end section.

Now in regard to what course should be taken. Having come to these two statements of fact, which are, as I understand, the same in substance that the attorney-general has stated, and which I assent to, that clears up a great deal of ground, and renders this hearing a very simple matter; bringing it down, as it does, to the statement of those two great facts. But what should be done next, or what course should be taken, assuming these two facts to be so, is a matter that perhaps requires some further consideration than I have given to it. It has been suggested that the legal construction of this contract should be submitted to the supreme court, because the governor and council and the attorney-general do not feel



authorized to give up the claim that, on a true construction of this contract, and in view of these facts which I have stated, the Messrs. Shanly are bound to do this work of arching. That being so, what is to be done next? If the officers of the State have not the authority to give up that claim, why then the next thing obviously for the Messrs. Shanly to do is to come to the tribunal which has the authority. We have been dealing with the agents of the Commonwealth before, but now we come to the Commonwealth itself. Mr. Shanly must always believe that, according to the true construction of this contract, he is not bound to do this work which is now in question, and if the State, through the legislature, should see it in the same light, why then of course they will not require him to do it. Then, as Mr. Shanly put it the other day, even if it should appear to the legislature that according to the true construction of the contract he is bound to do this work as a matter of strict law, still it would be a very hard construction to force upon him, in view of the circumstances which have been disclosed. We had a discussion, as you will remember, the other day, as to what should be the course of this hearing; I should be very glad to simplify it, and hope that it may be simplified and ended as speedily as possible.

The CHAIRMAN.—You do not, Mr. Allen, quite meet the question which I wanted to get light upon, and that is this: you are presenting to this Committee here a case which takes two forms: one is relief, the other is relief from a claim upon you to do something which you say you are not bound to do; they are both relief, but one is a matter of right, and the other is a matter of pure relief. Now what I want to get at is this: as I understand from Mr. Train, the legal question involved in the construction of this contract you do not care to have the legislature troubled with, and I do not know whether I understood him correctly. That is what I want to find out. Suppose the Committee should report that Mr. Shanly entered into a contract, and it is considered that he is bound to do the work under that contract, but he says he cannot, and that it is unconscionable, and that he ought not to be obliged to, and that he is entitled to relief; that is presenting the case in one view. The other view is, that he says he is not bound to do it under the contract legally, that if he is bound to do it it is unconscionable because it was not contemplated, and on both grounds he seeks to be relieved from the claim which the governor and council make upon him to do it. Now, whether you desire to have your claim presented upon both grounds, the legal and the equitable, or whether you desire to abandon the legal and trust it to the legislature upon the naked equitable claim,—that is the point.

Mr. ALLEN.—Well, I did not suppose that we were to be called

upon to make a claim of right or equity like that. I did not suppose either that we were to be asked to abandon the ground that according to a true legal construction of the contract we are not bound to do this work.

The CHAIRMAN.—I beg your pardon, I am not asking you to do that; I am asking you whether I understood Mr. Train aright.

Mr. ALLEN.—I knew you did not ask it, but I did not suppose I was to be asked by the officers of the Commonwealth to abandon the ground that the legal construction of the contract does not require Mr. Shanly to do that work. I do not suppose that Mr. Shanly would be willing to recognize, in any way, that the State has any legal right to ask him to do that work. He has always taken the contrary position since the question was raised, and he is just as firmly now of that opinion as he ever has been. But, nevertheless, in coming to the legislature, which is the State, I do not see that there is any reason why Mr. Shanly may not come, just as if the State were an individual. If you and I, Mr. Chairman, have a contract together, by which I am to do certain work for you, and a question arises under it, your agent may tell me that I am bound to do a certain amount of work which I may not think myself bound to do, and so your agent and myself may not agree, but then I come to you and I say, "Let us look over this contract together, and let us see whether you can, or ought to ask and require me to do this work"; and you say, on looking at it, "Well, I don't want to insist on that construction, I will give up that claim; my agent has made a claim on you which I will not insist upon." You may do that, or you may say, "Go to the court and get your legal rights settled." Well, if you are ready to give up the claim without sending me to court, why that is better than my going to court; if you are not ready to give it up, why then you will send me to court to ascertain what my rights are. Now, if the Commonwealth will put it on this ground, "Without going into any further question on this subject, and without undertaking to enforce this legal view which we have heretofore taken, under the circumstances we will not insist upon this claim which has been made by our agents"; if the Commonwealth will do that, we do not care what reasons may operate upon the minds of individual legislators, and they may act upon such reasons as they may think proper.

The CHAIRMAN.—My idea with reference to this matter is this: This is a Committee, representing three hundred men, more or less. Now, whatever the conclusion to which this Committee arrives on this subject, it has to be reported to the legislature for their action,—confirmation, rejection or whatever it may be. In the report, the case has to be put in some form or other. Suppose the Committee

should come to the conclusion that Mr. Shanly was bound, under his contract, to do the whole of this work; or suppose they should come to the conclusion that he is not bound to do it; what I want to know is whether this part of the case which has been heard to some extent before this Committee is to be abandoned and the question put to the legislature on the naked ground of relief, or whether it is desired that the entire question shall be reported upon and the opinion of the Committee given, such as it may be, on the obligation of the Messrs. Shanly to do this work.

Mr. TRAIN.—I thought that Mr. Allen and I understood each other perfectly, and I still think so; but I may not perhaps be very skilful in the use of language, and may not have put it as I ought to have put it. My position this morning arose out of this statement of Mr. Shanly, made the other day, and which I will read from the "Daily Advertiser": "My position is exactly this, that if I am required to do this work I must stop; I cannot do it. I am well able to perform what I consider my contract, but not \$300,000 beyond."

Now, I assume that to be exactly true, and, being true, it is of no consequence whatever whether he is bound by the contract or not; and hence I was ready to take the ground which I have taken here this morning, and ready to confer with Brother Allen. We agreed, I think, in what would be proved in the results of the investigation, and I think we were agreed, so far as we were concerned, to have the inquiry, so far as it rested on the legal proposition, stopped, letting the inquiry go on in the other branch of the case. In that case, I should withdraw from the hearing, and if Mr. Shanly should accomplish what he desires, or if he does not accomplish what he desires, and the legal question afterwards became of any importance, it could then be disposed of.

As the case stands now, it would be of no use to this Commonwealth, even if the supreme court upheld the construction which I have given to the contract, simply from the inability of Mr. Shanly to perform it. I do not think I can be misunderstood now, and perhaps a further conference with Mr. Allen might result in a more definite understanding than I have been already enabled to enunciate, as I have not had an opportunity to confer with him since he saw his client.

The CHAIRMAN.—Does this mean that the responsibility of determining that the Shanlys shall be relieved from the claim made upon them by the executive is to be thrown upon this Committee?

Mr. TRAIN.—I do not so understand it.

The CHAIRMAN.—If that is so, I do not believe that the Committee will assume any such responsibility.

Mr. TRAIN.—My understanding was, that the claim, without



being abandoned, should be put aside; that it should disappear from the inquiry and the case go on, as though it were not here, and if it ever afterwards became necessary to revive it, it would be in the power of the executive to do it.

The CHAIRMAN.—The matter stands exactly as you put it; that is, assuming Mr. Shanly's statement to be true, that he could not perform this work if he were called upon to do it. Now, what is there in the way of Mr. Shanly and the executive dealing together without troubling the legislature with this question? Is there any legal difficulty in the way of their arranging this matter between themselves?

Mr. TRAIN.—If you mean to inquire whether we could deal without legislation, I do not think the executive would feel authorized to deal without additional legislation. My own idea is, that the power of the executive under the chapter of 1868 and the additional chapter, was exhausted when the contract was made.

The CHAIRMAN.—Is it not within the power of the governor and council to look at this contract exactly as Mr. Shanly looks at it? Supposing it would satisfy their consciences and they could be brought to believe that the proper construction of the contract was exactly what Mr. Shanly gives to it, is it not within their power to deal with the question without any further legislation upon it?

Mr. TRAIN.—No, sir; there is an appropriation; they could not go forward without that.

The CHAIRMAN.—Precisely; they need not go forward; but suppose they should be of the same opinion as Mr. Shanly, that his contract is performed when he has done so much and left that arching, then of course they have got to get an appropriation to do that and for other purposes. Now, what is in the way of the governor and council, if they see fit to do so, saying to Mr. Shanly, "Your contract is performed when you have done the work mentioned in the schedule"?

Mr. TRAIN.—They never can say that, I believe, because they do not believe it.

The CHAIRMAN.—Exactly; and they do not believe it because of the legal construction which they give to the contract.

Mr. TRAIN.—Yes, sir.

The CHAIRMAN.—Now, having given that legal construction to the contract, they desire the legislature to say to Mr. Shanly: "We relieve you from the performance of the duty which our agents have determined you are bound to perform under your contract, without stopping to decide the question of whether you are bound to perform it"; thus throwing the responsibility of this relief upon the shoulders of the legislature, claiming all the time themselves that the Shanlys

are bound to do this work under the contract. Is not that the position in which the case is left if you abandon the legal proposition? The idea I have of it is that, and I want to know whether we are expected to go on and grant relief to the Shanlys, without at all considering the question of whether they need any relief?

MR. TRAIN.—Well, I can only say, so far as I apprehend the remarks of the Chairman, that the executive would not yield the construction which they claim for the contract, but they agree that Mr. Shanly cannot perform it under the construction that they claim, and that the work which they claim is called for under the contract never entered into the minds of the contracting parties as work which would be required to be done under the contract; and so far that may be a ground for relief.

MR. GRANGER.—Well, Mr. Train, in conceding that point, don't you give up the legal part of it?

MR. TRAIN.—No, sir; we do not intend to give up the legal part.

MR. GRANGER.—As I have understood it, you said, at first, that it was intended to do everything under the contract, and now you give in that this work was not intended to be done.

MR. TRAIN.—Oh, no.

THE CHAIRMAN.—It was intended to complete the Tunnel, but it was not thought, at the time, that it was necessary to do this arching; this outlay was not contemplated, but it was contemplated that whatever was necessary must be done.

MR. TRAIN.—Exactly; it was intended to complete, and do all that was necessary, but this was not thought necessary at the time.

MR. SLEEPER.—It seems to me that a new element comes in this morning. Mr. Shanly asks to be relieved from performing this work, even if we allow him an extra compensation.

THE CHAIRMAN.—Well, Mr. Shanly says he does not want to do the work anyway.

MR. SLEEPER.—Now, the contract, it has been claimed by the attorney-general, in the express terms of the last clause, provides that the Tunnel shall be completed. If this work, not being in the schedule, was not contemplated in the price, it seems to me that the only question is as to his pay, and not as to his obligations to complete the Tunnel; but he comes and asks to be relieved from both.

MR. ALLEN.—I do not think I quite catch what is in the mind of Mr. Sleeper. I do not understand myself that Mr. Shanly has made any suggestion of the kind.

THE CHAIRMAN.—The suggestion comes both ways. You say you are not bound to do the work at all. Mr. Train says, in his construction, you are bound to do it; and it is a question, perhaps, of a further appropriation to do it.

Mr. ALLEN.—I understood Mr. Sleeper to say that Mr. Shanly was asking for some extra compensation, even though he did not do the work.

Mr. SLEEPER.—No, sir.

Mr. ALLEN.—I did not understand the proposition then.

The CHAIRMAN.—It is this, Mr. Allen: The attorney-general claims that this work is to be done under this contract, and that it is a question now of a further appropriation to do it; and you claim that the work is not to be done under the contract, and that it is a question of whether that construction should be given to it, or whether you should be relieved from it,—not a relief by being paid for it, but from doing it at all.

Mr. ALLEN.—I suppose, with regard to that, if this contract should not cover this work, and it should be determined that the Shanlys are not bound to do it, under the contract, why, then, it would be a matter of negotiation in the future how it should be done. If the contract does not bind him to do the work, then he is not bound to it under any contract now existing, and it would become simply a matter for future arrangement.

Mr. NUTTING.—Suppose we decide, Mr. Allen, that he is bound, under the contract, to do it, then there is a question of whether we shall pay him \$300,000 for doing it. But another question comes in, as I understand it: shall we relieve him from doing it, and let somebody else do it?

Mr. ALLEN.—That is, on the assumption that he is bound to do the work.

Mr. NUTTING.—I understood that it was to be left so; that we should not decide whether you were right or the attorney-general; and he wants to be relieved, in any case, whether you or he is right.

Mr. ALLEN.—Well, that has not been the subject of negotiation between the parties. He has never been called upon to say on what terms he would do the work; he has only been called on to do it, under his contract; that he has declined to do, and no further call has been made upon him; no negotiation has been opened, made or asked; and, therefore, this is a speculation upon a stage of the case which has not yet been reached.

Mr. FULLER.—It seems to me that this whole question, if I understand the attorney-general, is put in so plain a light, that this matter might be disposed of, conditionally, without offending anybody or doing anybody any injury. In the first place, the construction of Mr. Shanly is, that this work is not included in the contract. The governor and council claim that it is. But, whether it is, or is not, it is admitted he is not able to complete the work. And the question



now is, whether we shall ask him to complete that work, and give him compensation, or send him to the supreme court? I agree with the attorney-general, that there is a legal tribunal appointed by the people, and that we should not pass on the legal question. We are to settle the relief question, and let that tribunal settle the legal question, if it comes to that. That is your point, Mr. Sleeper, if I understand it.

Mr. SLEEPER.—Yes.

The CHAIRMAN.—Well, is there anything further to be said on either side?

Mr. TRAIN.—I supposed, when I began this morning, that what I said was to be acquiesced in by the other side, and I do not know but that they do acquiesce in it now. I am not quite sure whether time would be of any use to us. Mr. Allen can say.

The CHAIRMAN.—We will adjourn this hearing until to-morrow morning, if you wish it. If you desire further time, or a further conference, or further evidence on the hearing, take your own course about it.

Mr. SHANLY.—Mr. Chairman, I wish now just to say a few words, especially in reference to the observation which fell from yourself, when Mr. Train sat down, a short time since. You said, the case stood exactly as Mr. Train puts it. I do not think it does. Mr. Train has stated that we cannot do this work; that, therefore, if this case goes against us, nothing will be done.

The CHAIRMAN.—You misunderstood me. I said, “assuming that the case stood as Mr. Train put it.”

Mr. SHANLY.—Yes, sir, exactly. Mr. Train says, that then we should stand in this position, that nothing has been done. But I hold something has been done. It is just this: that, in that case, the governor and council have got our money to do it with, and it is twice as much of our money as is wanted to do it. And they say, “We are not only going to spend your money, but we want you to stand by and spend it.” You make it a cruel matter, as well as a hardship. “You shall stand by,” you say, “for a twelve months and expend that money.” All that twelve months is capital; it is money; our time is money; and all that time we are to stand by, chained to the Hoosac Mountain. So that, as I said before, the gain is certain to the State, and the loss is certain to the Shanlys,—a double loss; a loss of time and a loss of capital. With regard to the observations which fell from Mr. Sleeper, I do not wish to introduce a new question. I merely mean that if we are going to get relief, we do not want to be placed in that position,—that we are to do work which it is no advantage to us to do. I hold, as I said before, that they can get fifty people to do that work as cheaply as

we can. But I think that, if it is admitted that we are not to do that work, and there is to be a new appropriation, that settles it. True, that they do not gain anything; we may make a little, possibly, by taking the contract. If they go to the legislature for a new appropriation to carry it on, we cannot say, "That belongs to us." On the other hand, it ought not to be that the governor and council can say to us, "You can spend that money, and do that work, and nobody else." Therefore, it seems to me, that if there is a new appropriation, that settles the whole question; and then, if they come to us, and say, "We will negotiate with you," we may do it. I think it does not necessarily follow, that, because we do not want our names put in as the positive contractors for this work, therefore we have introduced a new feature into the hearing. What relief we get does not positively bind us to do whatever work the Commonwealth wants done in the Tunnel. We leave the Commonwealth free to make a new contract as they like; and, if they wish to negotiate with us, we shall be outside, and in a position to do it.

Mr. TRAIN.—I think I ought to say, Mr. Chairman, that as at present advised, and as the thing lies in my mind this morning. I should not be willing, as the representative of the executive or of the Commonwealth, to agree that the Shanlys should be relieved from the performance of this contract, as I understand it; but I should be entirely willing that this Committee might report any extra compensation for its performance which they thought the Shanlys were fairly entitled to. I believe that I have stated that so that I cannot be misunderstood, and I think that was called for by the remarks of my friend on the other side.

Mr. SLEEPER.—That answers the query which I raised.

Mr. TRAIN.—I did not come in here understanding that Mr. Shanly was going to take the ground he now takes.

Mr. GRANGER.—Well, as I understand Mr. Shanly, he wants to be freed from the interpretation the State originally put on the terms of this contract; simply saying that he is not required to do this arching under this contract, and he wants it left there, so that he may come in and compete for it if the State makes another advance or appropriation to complete it; but he does not want to be bound to do so. He simply asks to be freed from the contract as they have heretofore understood it; that is, that he was to do this work under his contract. Now, as I understand the attorney-general, he wishes that the Committee should report that the Shanlys are bound to go on and do that, and they may also report for an appropriation, outside of his original contract, to do it.

The CHAIRMAN.—I think I have got Mr. Train's statement here, "that he is not willing to agree that the Shanlys should be released

from the performance of the contract, but would give them an additional appropriation to enable them to complete it."

Mr. TRAIN.—Yes, sir, that is it exactly.

Mr. GRANGER.—That, I think, puts it in an entirely new light.

Mr. ALLEN.—Mr. Shanly would not like to assent to any construction which would involve an admission that he was bound to do this work under this contract, and I have never understood before that it was intended to put him in that position.

The CHAIRMAN.—I do not understand that you agree to this at all. Your claim is that he is not bound to perform the contract, or rather not bound to do this particular work under the contract, as Mr. Train understands it, and if the legislature should be of opinion that he is bound to do it, he should be relieved from it. You do not want any appropriation which should enable him to complete the contract.

Mr. ALLEN.—That is a matter which, I understand, is for future negotiation entirely.

The CHAIRMAN.—When I say "complete the contract," I mean, to complete it as Mr. Train understands it.

Mr. ALLEN.—That contains an imputation that the contract includes this work, and that is the question in dispute.

Mr. FULLER.—You would not be willing to have this question remain over as a disputed question, and have this Committee report to make such further appropriation as should pay for this entire arching, and let the matter rest there, saying nothing about any legal construction of this contract, because I suppose your claim is this: that if it contains anything, directly or indirectly, either by word or in writing implying that he is "to complete the contract," then in case any new thing should break out he would be held to make that good also.

Mr. ALLEN.—I do not see that your position, as you state it, contains any implication that Mr. Shanly is bound to do this particular work.

Mr. FULLER.—No, sir, not at all.

Mr. ALLEN.—That is the feature I objected to.

Mr. FULLER.—I understood what your objection was. Would that be satisfactory to you?

Mr. ALLEN.—(After consulting Mr. Shanly.) Mr. Shanly says that would be satisfactory.

Mr. TRAIN.—Now I would like to know exactly what is satisfactory to Mr. Shanly.

Mr. FULLER.—The question I asked in substance was: If this question is left as an open question, one side claiming that it is included in the contract, and the other that it is outside the contract,



and the Committee should report that he is entitled at least to relief and to a sufficient sum to pay for the construction of this arching; whether that would be satisfactory to them or not. Mr. Allen now says that it would be.

Mr. ALLEN.—I do not think you state it this time as you did before.

Mr. FULLER.—Mr. Allen, will you state it as I did before?

Mr. ALLEN.—In this last statement you say that there should be a bill reported for his relief——

Mr. FULLER.—And to pay him for this work——

Mr. ALLEN.—You said before “an appropriation for this work,” and now you say “to pay him,” leaving it to be inferred that he is to do this work.

The CHAIRMAN.—I do not see that that settles anything between the Commonwealth and Mr. Shanly. The legislature making an appropriation of one and a half million of dollars, that don't settle this hash at all.

Mr. GRANGER.—As I understand the matter, they have asked for a Resolve to be passed that, according to the true construction of this contract, they shall not be asked to do this arching. I do not see how we can report an appropriation to enable the Shanlys or anybody else to do this work.

A private consultation of the Committee with counsel then took place; and the hearing was then

Adjourned to Tuesday, March 3d, at 11 o'clock, A.M.

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TUESDAY, March 3, 1874.

The Committee met at 11.30, A.M.

TESTIMONY OF EDWARD S. PHILBRICK.

Q. By Mr. TRAIN.—You are the consulting engineer of the Tunnel?

A. Yes, sir.

Q. And how long have you held that position?

A. For three years.

Q. Who was your immediate predecessor?

A. Mr. James Laurie.

Q. Will you describe briefly to the Committee your duties as consulting engineer?

A. My duties were to keep myself informed as to the progress of the work and to give such advice as was asked for to the superintendent, the engineer, Mr. Frost, or to the governor and council whenever called upon, and to look after and examine every month the computations on which the certificates of payment were based, verify them, and certify and approve Mr. Frost's certificates of payment. I was also made responsible for the accuracy of the lines on independent examination.

Q. When you first began your duties, how far had the work progressed?

A. Three years ago?

Q. Yes.

A. Well, to give any definite figures I should have to refer to the profiles. There is a profile which shows the work of 1873 for the central shaft, which I have made for the use of the Committee, and here is the one previous, showing the amount which remained to be done on the first of February.

[Witness handed in two profiles to the Chairman, and explained them.]

The red represents work that was done in 1873. That part not dated is not yet done. The dates show when each block was done. I have not got the February work on this profile, but I can tell about what it is. They took out a block here (pointing it out), in February, and they were also at work up here in this roof.

Q. By the CHAIRMAN.—What was the object of shading this?

A. Merely to make the progress more evident to the eye, and show what each year accomplished.

Q. By Mr. ADAMS.—This is all there is left to do, what you represent here?

A. No, there is half a mile or so more west of that, with a bottom like this; perhaps not half a mile, but a considerable portion; this is the portion on which this discussion arose.

Q. By the CHAIRMAN.—This wet granite; where did you strike it?

A. I have not found any wet granite at all. The wettest parts of the Tunnel are along here (pointing to the profile), and some portions about a mile and a half further west.

Q. What do you call this if it is not wet granite?

A. It is what is called mica schist; it is the same as there is all through the Tunnel.

[Mr. Philbrick, at this point, produced several specimens of the Tunnel rock, and made remarks upon them as follows:]

This piece came from along here (pointing to the profile), in the portion which now needs arching, and which was opened last September. That is quite as characteristic of mica schist as this which

came out away east of the shaft, where everybody has called it mica schist. One looks as much like granite as the other; they are neither of them granite.

Q. By Mr. ADAMS.—You would call this nearer granite, would you not, than that?

A. No, sir; they are both mica schist entirely.

Q. What are its component parts?

A. Mica, felspar, a little limestone, and a little quartz. It is composed of the same ingredients as granite.

Q. By the CHAIRMAN.—You do not account for the necessity of arching, then, by reason of having struck different rock?

A. No, sir; it is for the reason of the nature of the seams in it. Here is a piece of the average rock nearer the shaft coming in somewhere in that position (referring to the profile); this came from the east end, out here away east.

Q. By Mr. GRANGER.—That is in the dry Tunnel?

A. Yes, sir; that is in the dry Tunnel.

Q. Well, there is a good deal more felspar in this than in this? (pointing witness to specimens of rock.)

A. Well, there is not in this (pointing to a third specimen), which is from a more insecure place than is that which you have in your hand.

Q. By Mr. TRAIN.—The Chairman asked you, Mr. Philbrick, in relation to the arching. I wish you would follow that topic out. The suggestion he made was that you did not find the necessity for arching upon a change in the character of the rock, but for some other reason. Will you please state that theory?

A. We found no radical change in the character of the rock, except that some portions were crystallized more than others. The portion of the central shaft for two miles, nearly all the way to the western shaft, is more crystallized as a general thing, than the eastern part of the Tunnel, and at different points brought in more water. But the amount of water brought in was no index to the insecurity of the rock. We found, two or three years ago, in the east end working, east of the shaft, this same character of rock precisely, bringing in considerable quantities of water, but that gave no trouble. The character of the rock, both as to its water-seams and texture, is almost precisely similar there to that in the portion which now needs arching, except that it is not so seamy. The instability of the rock depends on the number and looseness of the seams, and not, in this particular mountain, upon the texture of the rock until you approach the west end, where it turns out to be what was formerly called demoralized rock; that is an entirely different character of rock.



The CHAIRMAN.—That is where it was first intended to arch?

A. Yes, sir; but there was no definite line between that and the sound rock, it had no definite line of gradation, and it was a matter of judgment to determine where that unstable portion would need arching. It was a matter of judgment and not of infallibility, and subject to the test of time, simply because there was, I say, no well defined boundaries dividing the two formations. It was an insensible gradation from one rock to the other. The rock at the west end was formed of exactly the same material as this, except that it had perhaps a little more mica.

Q. By the CHAIRMAN.—Are these seams in the rock natural, or are they made by blasting?

A. They are both, and one reason why we cannot determine the stability of the rock when the heading is first opened, in many cases, is from doubt whether such seams, as we find are natural seams such as would pervade a considerable portion of the mass above the Tunnel, or whether they are merely little shattered seams from the effect of blasting. I found in more than one case where the rock appeared treacherous immediately after opening it, that upon getting off the loose blocks which appeared to have been shaken in blasting, there was sound material above, and the character of the roof was much improved in many cases by taking off blocks; so that I have considered it impossible to determine with any reasonable degree of definiteness until some time after the rock has been opened, whether we should be obliged finally to arch it, or not, during the whole progress of that part of the work.

Q. By the CHAIRMAN.—Do you mean to say that there were some portions of the rock where excavation was made which you thought at first might need arching, but which you subsequently became satisfied did not need it?

A. Yes, sir. The lapse of time and taking off a few loose blocks which we at first thought indicated a general character of seaminess in the roof of the Tunnel proved that it was sound, and that these few flakes were developed by the blast, the material above being quite sound. In some cases where the first advance has been below the roof, and the roof of that heading appeared loose and insecure after taking off several feet above, we found perfectly sound material.

Q. By Mr. GRANGER.—How much of this territory which it is proposed to arch is in this uncertain state?

A. There is a certain amount of it now which I consider decidedly needs arching, and there is another portion of it upon which I should not like to pass any definite opinion until some further time had elapsed and some further tests had been made.

Q. Have there been any accidents there from the falling of rocks from the roof?

A. Well, there have been occasionally accidents throughout the construction of the Tunnel, and men have been killed by rocks falling immediately after the blast; men going in directly after the blast are always subject to that risk.

Q. On examination after that has occurred, what have you attributed the accident to—a seam, or the shatter of the blast?

A. It is almost impossible to determine whether it is owing to a seam, or the result of blasting. That portion of the rock which has developed this insecure character was doubtless full of natural seams, but they are not always the wettest seams; as I said before, there is a part of this more crystallised rock a little west of the central shaft, which was worked a year ago, which is quite as wet, and has all the characteristics of this rock except that it is more secure.

Q. By Mr. TRAIN.—When is it possible to determine whether arching would be required or not?

A. Well, in some cases we find it insecure, decidedly insecure, beyond doubt, very soon after opening it; in other cases, insecurity is developed several months afterwards; and there are still other cases where it has an insecure appearance at first, but turns out to be better afterwards.

Q. Well, you must always work up to the roof, I take it, until you determine?

A. Yes, of course, until you get to the actual roof which you mean to use, you do not know much about it; the rock does not change suddenly in its nature, it is an insensible gradation, as I said before, everywhere, and it is impossible to determine from a first inspection how many seams there are in the rock, because there are always a certain number of seams apparent after opening a rock. The whole east end of the Tunnel or central shaft was drilled much easier than the western end, where we have had this trouble; they have used more steel and more powder in the west end of the Tunnel?

Q. Has time developed any more arching than was anticipated in that western section,—the one provided for in the four and one-half million of brick?

A. At the time we stopped laying brick there, a year ago last summer, I considered there was a chance of avoiding the arching of the next 200 or 300 feet; I had not then settled in my mind that it was necessary; I thought it might be avoided; and on that account I thought it was best to defer working upon it, until we found it had become a necessity, beyond a question. On that ground Mr.

Frost advised with me about letting the brickyard, and I advised him, if he could let it so that we could get it back when we wanted it, to do so, as I thought we might as well get money out of it for that year, and it would be unreasonable to require the contractors to build arching there until we felt certain it would be necessary.

Q. When the brickyard was taken from the Shanlys was there any arching remaining to be done?

A. There was 40 feet in the east end which I always knew would require arching, a little soft section which was timbered at once when it was opened, and which has remained timbered ever since; but the Tunnel had not pierced the mountain when it was first found, and I considered there was no need of carting bricks over the mountain to arch that 40 or 50 feet when, by waiting till afterwards, we could easily cart them through; it was only a month's work.

Q. Now, with reference to this 1,800 feet which Mr. Shanly has talked so much about, when did any development occur in that portion of the work?

A. The first I heard of it, as presenting any alarming features, any features, that is, which would positively demand arching, was last October when he had reached that point, directly over where he is now at work on the bottom.

Q. Which way was he going?

A. He was working westwardly, on the top, as the dates show, and during that month of October a treacherous spot appeared in the roof.

Q. By the CHAIRMAN.—That was the first one?

A. Yes, that was the first one, of a pronounced and decided character. I had always regarded it as a question whether we needed any further arching, and so far as the necessity was pronounced and evident, the orders to do it were given. Orders were given last summer to arch in the west end; I think as long ago as last May I determined that, in consultation with Mr. Frost.

Q. By Mr. ALLEN.—You mean July, don't you, Mr. Philbrick?

A. I examined that in May and agreed with Mr. Frost, and I think we gave orders very soon after that. I have had no official communications with the contractors, as that has not been part of my business; all official communications have been with Mr. Frost; my voice was advisory, with him and the council.

Q. By Mr. TRAIN.—Well, can you give an opinion, relying upon yourself, as to whether the arching required in the section of 1,800 feet, is due to the character of the rock, or to the nature of the explosives which were used in piercing the mountain?

A. Well, I presume there was no difference in the character of



the explosives used there and all the way through the Tunnel ; glycerine has been used there for several years.

Q. When the enterprise first began, glycerine was not known?

A. No ; but it has been used ever since the contractors have been there, and I have never been informed of any change in the manner of work on that particular point. As compared with other explosives there is undoubtedly more risk of shattering the rock by glycerine than by the use of black powder, but the advantages of using glycerine are so great that I never thought of interfering with it.

Q. The explosive power is so much greater?

A. Yes, sir.

Q. Is there any difference between glycerine and dualin ?

A. There is no difference in the elements ; dualin is nothing but glycerine soaked in sawdust, and sometimes in earth powder merely to make it less fluid ; glycerine is the explosive in each case. After the explosion takes place the earth powder remains sand as it was before, sawdust is probably burnt up ; the solid part of the powder in both cases does not contribute anything to the explosive power, and is merely a vehicle to carry it with.

Q. By Mr. GRANGER.—As far as you examined it, Mr. Philbrick, how much is there that needs arching?

A. In this disputed section?

Q. Yes, sir.

A. I think 500 feet certainly needs arching, and perhaps 1,000 feet. I have not sufficiently examined within the last month to determine between 500 and 1,000 feet ; I think, however, that 500 feet will certainly need arching ; but 1,000 feet, allowing for margin, will, I think, be ample, as far as I can judge at present.

Q. I noticed at the final blast given last fall, that immediately where the rock opened, you could take it off with your fingers.

A. I noticed that myself.

Q. I questioned then how far the rock was affected by the blast.

A. I was in there three days after that blast was made, and passed back and forth through the opening several times. About two or three hours after I first passed there, a workman came to me and said it was unsafe there, and they applied bars and pecked down several tons just over where I had been standing. That was undoubtedly the result of the shattering of the blast, as above it was perfectly sound.

Q. By the CHAIRMAN.—Well, you lay it to both, as I understand it ; you think the necessity for arching comes both from the blasting and from the water?

A. No ; I do not think the water has much to do with it. The

water is merely an accident that happens where the seam connects with the surface.

Q. It has been said here by gentlemen, I think by Mr. Shanly principally, that it is on account of the water, at any rate to a great extent, that the danger arises.

A. Well, my view of it is, that the need of arching comes from the seaminess of the rock. Now, those seams may connect with the surface, in which case they carry water; or they may not connect with the surface; in which case they are dry. The mere fact of water coming in shows there are a certain number of seams; but it does not always follow that seams cut up the rock in all directions, so as to make it insecure. There was a portion of the west end where the soundness of the rock was never disputed, and where great quantities of water came in; and even in this immediate vicinity, the points where most water comes in are not the most insecure.

Q. Well, in your investigation of the work which has been done, where they have reached the roof, you are satisfied in your own mind that a certain amount of arching is necessary?

A. Yes; I think about 500 feet.

Q. And the rest of it is a question?

A. Of the rest I have not sufficient information to judge.

Q. In certain portions, I suppose, the roof has not yet been reached?

A. I think not; I have not heard the last few weeks how that work on the roof has progressed.

Mr. SHANLY.—There are 200 feet to come out yet.

Q. By Mr. TRAIN.—Then, if I understand you, Mr. Philbrick, the mere presence of water does not indicate any necessity for arching?

A. No, sir; I have never considered it as a certain criterion. It certainly indicates a certain amount of seams, and that they connect with the surface, and so bring water down; but some of the wettest places we have found are perfectly secure. I think the course which has been pursued in regard to directing the amount of arching to be done has been the only one consistent with common sense. If the rock had been of such pronounced instability as to leave no question of its insecurity when it was first opened, of course orders would have been given immediately to arch. But the rock being of that uncertain character which develops its real nature only by the lapse of weeks or months, it would have been very unreasonable, I think, for the engineers to have required the Tunnel to be enlarged, until they were perfectly positive that such work would be necessary.

Q. When was the roof, west of the shaft, struck?

A. It was struck in last July. They did not work, in July, the whole size of the roof, but they worked up in points to the roof; in August they worked up fully to the roof.

Q. And the soft place you speak of was struck in October?

A. Yes, that was so pronounced as to be beyond question; but it was only of that character for a short distance; it assumed a harder texture again, and, eventually, became doubtful.

Q. That place they were directed to arch?

A. Well, that place was so short that there was no immediate necessity to arch it, and no orders were necessary until they began enlarging. The moment they began to enlarge, last September, orders were given.

Q. You say that fell in of its own accord?

A. Yes, I think it is quite high enough for arching at that particular point.

Q. Does that still show that it is demoralized above?

A. Well, it is not demoralized, but it is certainly seamy to such an extent as to need arching; but the need of arching at that time did not affect the progress of the work, and so no orders were given until the enlargement came to be done in September.

Q. Well, I understand Mr. Shanly to complain that he was not ordered to arch soon enough?

Mr. ALLEN.—You understand him to complain of that?

Mr. TRAIN.—Yes.

Mr. SHANLY.—Not at all, Mr. Train.

Mr. TRAIN.—I understood him, among other things, to complain that he was never given any notice, until very recently, that arching was required.

Mr. SHANLY.—That is another question.

Mr. TRAIN.—Very good. What I want to get at, Mr. Philbrick, is, whether he was notified as soon as it was reasonably demonstrated by the engineers that arching was necessary?

A. Yes, sir, in my opinion he was notified as soon as was necessary. It was evident, in October, that arching would be needed; but orders to arch would not have affected the prosecution of the work at that time at all, and as there was no necessity to give any special orders at that time, none were given until the enlargement began, in September,—four months later.

Q. I understand Mr. Shanly to consider his orders as covering the entire 1,800 feet which he calls wet granite?

A. I have not seen the order, but such was not my intention in talking to Mr. Frost, and I do not think that is the fact.

Q. In all his testimony here, he has constantly spoken of 1,800



feet as requiring arching, and because of the character of the rock. Now, I understand you to say, that the geological character of the rock has not changed?

A. The geological character of the rock has not changed; it is the same as where he was at work, two years ago, in the west shaft, and water comes in just the same as it did there.

Q. And, so far as you are at present informed, the amount of arching required cannot exceed 1,000 feet?

A. I think that would be an ample allowance. I wish to state one fact about the actual amount of water developed in the western shaft. The amount has been talked of a great deal, but it has been measured repeatedly, and the greatest amount which was ever pumped out of the shaft was some 250 gallons a minute. I won't say but that he pumped faster sometimes, after an accumulation which he was reducing; but the greatest flow into the Tunnel was 250 gallons in a minute. The western shaft obliged them to pump four times that amount before it was drained. This pumping was done by the State, before the contract was made, from the small heading which was made from the west shaft; the shaft was only 300 feet deep, and where it was soft rock that obliged them to pump over 1,000 gallons a minute. And, after leaving that, there were a great many other wet places struck, but it all passed off through the drain, so that no annoyance was made by it; but the amount of water actually running out of that west end has been measured several times, and the amount which now falls in the central section through the hole of this section, on paper, runs eastward, passes the central shaft, and runs out at the east end, and that has been measured and found to be only 320 gallons a minute now. That includes the 250 gallons which we encountered a year ago last December, and an additional 70 gallons a minute which has been encountered by an advance westward during the last year, which all drains off at the same place; so that, to-day, there is only about 320 gallons per minute running through that whole section. The amount of water, therefore, running in there did not indicate that the mountain was all going to come in upon us, especially as the wettest places did not appear the most insecure. The amount of water running out at the west end, last November, including about two miles of Tunnel, gathering all the water to a meeting-point on last Thanksgiving Day to the west end, was only 930 gallons a minute, which was less than that once pumped out of the west shaft,—showing that the drainage of these seams, when first opened, exceeds their perpetual flow; that is, they carry more water for the first few weeks than they do perpetually afterwards.

Mr. GRANGER.—According to Professor Hitchcock's theory there is a probability that it will, some day, be a dry Tunnel.

A. That part at the west end, compared with the demoralized rock, is dry now.

Mr. TRAIN.—I understood, in connection with this matter of pumping, Mr. Shanly to make some complaints about his deficiency of pumping-gear?

A. The western heading, from the central shaft, was delayed for nearly a year—from May, 1872, to January, 1873—for lack of pumping-power.

A. Whose fault was that?

A. Well, it was a lack of power, but I am unable to say whose fault it was. That brings up the question whether it was the contractors' business to provide pumping-power in advance of the development of water. It was certainly, however, from lack of pumping-power that they met with that nine months' delay. The engine which did all the pumping was one put in by the State, and which Mr. Shanly found there. When Mr. Shanly commenced, the shaft was about half sunk, and, to facilitate the sinking of the shaft, there was a small pump rigged, which was spliced out from time to time as the shaft went down. Of course, after reaching the bottom of the shaft, and running east and west, more water was met with; that four-inch pump was found insufficient, and Mr. Shanly put in a larger one; but that was not put in until the smaller one had been drowned out, and considerable delay was created at the time in putting in the larger pump. Then, another delay was met with by the breaking down of the foundations of the gearing which ran that large pump. The foundations prepared for the smaller pumping-gear used in sinking the shaft were found to be insufficient for the heavier pump to work a heavier body of water upon, and after applying the gear to those foundations, they failed, creating a delay there. I think these delays would certainly have been foreseen and avoided if Mr. Shanly had thought it his business to have provided for the water before finding it.

Q. Well, he waited nine months, and was finally driven to put in larger pumps?

A. That delay of nine months was later, after the big pump was flooded, also, in May, 1872. The amount of water, it appears, in the western heading was so great that it got over the capacity of both his pumps. And then the question arose, whether to put in another, or wait for the drainage, and the result was that no further pumps were added, and they did wait for the drainage nine months.

Q. Did he ever put in any additional pumping-power?

A. No, sir, there was no other pumping-engine, except the one left by the State.

Q. I want to inquire of you, now, whether there has been any loss to the Shanlys in the execution of this job, by reason of their own inattention, or want of attention?

A. I have always supposed that it was through their lack of attention somewhat, but I have not been there enough to be able to say whether that is the case or not.

Mr. SHANLY.—I would like to say to the Committee, that I have no claim before them for loss. I have made none. I may have, incidentally, made a statement of such a fact, but I have no claim before the Committee for loss.

Mr. PHILBRICK.—I have seen work going on there which I have not thought was for Mr. Shanly's economy; but I did not examine the causes of it.

Q. By Mr. TRAIN.—Well, for example, work done outside the lines?

A. There was considerable done outside the lines in 1872, which might have been avoided.

Q. By Mr. GRANGER.—Was not that work outside the lines done for the purpose of saving trimming up afterwards?

A. If so, it was a very expensive way of saving, and I cannot conceive of any good reason for it. I never did, and I cannot to this day, understand why the work was so mismanaged. I supposed it must have been from inattention at the time, as I did not suppose Mr. Shanly would allow work to go on in that way, if he was there to see the folly of it.

Q. Did you ever call the attention of his foreman to it?

A. I spoke to Mr. Frost about it every month, and I asked him if Mr. Shanly was aware of it. He said that he sent him sections every month, and grades were given every week to the foreman, which was all we could do. I asked, further, why some steps were not taken to avoid it, by putting in a hand-pump; but I never got any satisfactory answer to it. They finally did put in a hand-pump in October, 1872, and directly got down inside the line within two weeks,—showing that it was perfectly feasible to have done so before. What little water there was, was trifling in amount altogether, and it was easily controlled by the hand-pump after they got it in.

Q. I want to get your views, Mr. Philbrick, upon this branch of inquiry; as to the most economical way of doing this arching; whether it would be by making the excavation for arching while the bottom is being taken out of the Tunnel? Whether, if he goes on as he has done since he was ordered to do this arching, and leaves



the arching to be done afterwards, it can be done as economically as if the work was all carried forward together?

A. No, sir; true economy requires the widening to be done at the time the enlargement is done. I believed Mr. Shanly the other day in his statement about that. If it were possible to determine, beyond doubt, when the enlargement begins, where we should need arching, there would be no hesitation in ordering it. There was one point in the east end, which has been spoken of, some forty feet, where arching is needed, which was struck before I was conversant with the work, more than three years ago, and timbered up because of its insecurity, and it has remained timbered up ever since, so that of course, everybody who saw the timber must know it would need arching eventually, as the timbering was merely a temporary expedient. But, as I said before, there was no need to haul the brick to arch that short distance, over the mountain then.

Q. Have you any idea what portion of his own personal time Mr. Shanly has given to the work?

A. I have no means of knowing. I have met him there about half the number of times I have been there, perhaps.

Q. Have you made any calculation as to what the cost of this arching, which Mr. Shanly claims is extra, would come to?

A. Well, it would cost per running foot something in the neighborhood of \$200, with the necessary enlargement items.

Q. By Mr. ADAMS.—That includes the enlargement and the brick?

A. Yes, sir.

Q. How much a foot?

A. Well, at least \$200, perhaps \$230 or \$240, depending upon various conditions which we could not arrive at at this time.

Q. You would say then from \$200 to \$250?

A. Yes, sir.

Q. Can the necessary bricks be had?

A. I understand from Mr. Shanly this morning that he can get two millions in addition to the present supply, which will arch one thousand feet, by July.

Q. But are there enough bricks on hand to do what would be required to be done between now and then?

A. Well, there are a million on hand, and of course the two million would not be delivered all at once in July; as I understand, they can all be delivered by July, so that by that time they could get fresh ones; but they cannot make fresh ones in this climate until June.

Q. Well, I want to know whether there are enough bricks in hand to get on with it?

A. There are about a million in stock now, and that would be considerable, and then there is the enlargement to go on with, which is the great thing required, and that is what has been ordered.

Q. And is it very important that that should go on?

A. True economy would require that it should go on together; the cost of the whole work would be less to have it all done at once.

Q. Can the work be accomplished between now and next November?

A. I think it very doubtful whether the whole amount of work could be finished in that time. I think, as Mr. Shanly said, it would be a physical impossibility for him to finish it by September.

Q. It would be of no use to try to use the Tunnel until this work was done?

A. I think it would be merely boys' work to try to use it before the arching was done.

Q. Have you noticed any interference, in any way, by Mr. Frost, or his assistant, to the injury of the contractors?

A. No, sir; I have never heard of anything of the kind.

Q. If there is any suggestion which you think now, Mr. Philbrick, you would like to make, please state it to the Committee?

A. No, sir; I do not remember any other points.

*Cross-Examined.*

Mr. ALLEN.—The way, Mr. Chairman, this matter was left the other day was such that, as I understood it, so far as the executive department was concerned, it would be recognized that the work we are now called upon to do, was not such as was contemplated at the time the contract was made; and I thought the executive department was perfectly content that it should be recognized by the Committee, and should now be treated as an extra contract. And, accordingly, Mr. Shanly was asked to make a bid, to say for how much he would do the work, and in pursuance of that request, and after conference with Mr. Philbrick, he has taken some steps to ascertain how much he would be willing to do it for. It was recognized, as I understood it, that it should be treated as extra work, and be paid for as such. Now, if that is the case, there is no question that we desire, on behalf of Mr. Shanly, to put to Mr. Philbrick.

There are some matters of opinion which he has expressed here with which, perhaps, all engineers would not agree, but in the present aspect of the case, if that is the understanding which is to be carried out, we do not care to go into these matters, because they are immaterial.

Mr. TRAIN.—Mr. Allen does not state the matter as I believe I stated it myself. Those whom I represent do not yield for a mo-

ment that this work is not required to be done under the contract, and do not propose ever to release Mr. Shanly from his obligation under the contract, but they are perfectly willing that Mr. Shanly should receive such equitable compensation for work which, at the time the contract was made, was not anticipated, as the legislature chooses to say is fair and proper. That was all I said the other day, and all I want to be understood as saying now!

The CHAIRMAN.—I did not understand that Mr. Allen meant to say you waived or yielded the claim you originally made here, that he was compelled to do that entire work under this contract; but that as it was not contemplated in the first place, the executive department was willing that the legislature should do whatever it thought fit in the way of relief, by making an additional appropriation for him.

Mr. ALLEN.—I understood that there was an entire assent that the cost of this additional work should be paid for, and in that view Mr. Shanly was seeking to make a bid, and had taken steps to enable him to do so. I had supposed that on meeting to-day, Mr. Shanly and Mr. Philbrick would have some further conference, in order that Mr. Shanly might get as definite information as possible in regard to the work required to be done, in Mr. Philbrick's opinion, so as to enable him to make a more intelligent bid.

The CHAIRMAN.—I was in hopes, when we parted the other day, that some understanding might be arrived at between the executive and Mr. Shanly.

Mr. ALLEN.—I do not desire to be understood, in what I said, as hinting that the attorney-general conceded his construction of the contract, that it was not correct; I did not understand him to concede that. But from what took place before the Committee on the last occasion, and especially from what took place afterwards, I certainly did understand that so far as the executive branch of the government was concerned, we had come into substantial accord.

The CHAIRMAN.—I thought from your proceeding with the investigation, you had failed.

Mr. TRAIN.—Mr. Allen perpetually talks about a bid and bids, as though whatever was to be done by the Shanlys was to be under some new contract or new arrangement. Now, I respectfully submit, that I have said nothing which justifies any such language. What I said I stand by, and when we had the conversation in relation to what should be reported by way of compensation, it was not upon the idea that he was to make a bid or make a new contract, but that if he was to do the work which in equity he ought to be paid for, beyond the limits of his contract, the value of that work should be ascertained, and the Committee should report an appro-



priation to cover it. What I said I have reported here and will read it. [Mr. Train read a lengthy extract from his remarks at the previous hearing.] I have only to say that there is no bidding about it, and I want to have the Committee, if they arrive at the conclusion that Mr. Shanly is entitled to some compensation, from the best sources of information, to ascertain how much it will cost Mr. Shanly to do the work for which they think he should have equitable compensation, and then report an appropriation.

The CHAIRMAN.—Now suppose the Committee should come to the conclusion that he is not bound to do it at all?

Mr. TRAIN.—Very well, sir, I cannot help that.

The CHAIRMAN.—The suggestions I made the other day were with a view to avoiding any inquiry as to that.

Mr. TRAIN.—That is what I wanted to accomplish myself.

The CHAIRMAN.—I hoped that the counsel, amongst themselves, and the Shanlys and the executive, would come to such an arrangement that there would be no necessity for any such inquiry as that.

Mr. TRAIN.—I don't know that it may not be accomplished yet; I have not seen Mr. Allen since the last hearing.

The CHAIRMAN.—You will remember also that some suggestions were made by some of the members of the Committee, and by myself too, as to the way of arriving at it, and, while there was no agreement, I suggested that so far as I was concerned, and so far as I knew the views of the Committee, if the executive and Mr. Shanly could arrange between themselves what sum it would be right and just and proper for Mr. Shanly to receive, the Committee would most likely feel bound to follow it, and if they could not so arrange between themselves, and desired us to go on with this case and give an opinion upon it, why then we would take it and do the best we could with it. Now, I did hope no further inquiry would be necessary, but, of course, you must do whatever you think best.

Mr. ALLEN.—When we come down to state all our views in detail we shall undoubtedly meet some little difficulty, but there are two or three things which may be stated as having been arrived at: the first is, that the executive department of the government are willing to pay for this arching outside of the western section as extra work; the second is, that Mr. Shanly is ready to do that work provided a price can be agreed upon; and it remains to be seen whether a price can be agreed upon between him and them. Now, stating it in that way, I believe it brings no new element into the controversy, and that is, I believe, the position it is in at the present moment.

The CHAIRMAN.—Is it not better that the Messrs. Shanly and the executive shall exhaust the means at hand to arrive at a result them-

selves, rather than leave it as a matter of controversy? Putting it exactly as the attorney-general has put it, it is a fruitless warfare, even if he should succeed in establishing the proposition he has set up. Now, it seems to me that the parties themselves who are immediately dealing with this subject ought to exhaust all means of arriving at a conclusion before they come to us, because they can do it so much better than we can; but if they cannot do it, and it is left for us, after all, why, of course, we will do the best we can with it.

Mr. TRAIN.—I agree with the Chairman entirely. There is only one thing I desire. Mr. Allen, in his opening statement,—and Mr. Shanly did the same thing in the course of his statement,—made an assertion in relation to the engineers which I think entitles them to be heard in reply, especially Mr. Frost. Mr. Philbrick you have heard already. So far as these gentlemen are personally involved, I think it due to them to give them an opportunity of correcting any impression that may have been, either intentionally or otherwise, created adversely to them. I should like Mr. Frost to have an opportunity of making his own statement in reply to the opening of Mr. Allen, and to any remarks which fell from Mr. Shanly, affecting him.

Mr. ALLEN.—I have no objection at all, but it is not in my mind that you have asked Mr. Philbrick about any matters that had been brought up here by me or Mr. Shanly. I did make an allusion the first day which did not come from Mr. Shanly. I called attention to what Mr. Laurie said, but I did not undertake to endorse it; I merely quoted it.

Mr. TRAIN.—I think brother Allen made a mistake there; Mr. Laurie undoubtedly did make an attack on Mr. Frost. I had to read it, too, to justify a letter which Mr. Allen read,—a letter showing that Mr. Shanly was not the first man who had complained of Mr. Frost before. Now, Mr. Frost was all right, and Mr. Laurie was all wrong, which was afterwards demonstrated. Mr. Laurie was discharged, and Mr. Philbrick took his place, and Mr. Frost has the same feeling in the matter as any gentleman would; he wants to be set right before this Committee, and in the minds of the public, as well as of the gentlemen who heard the statement made.

The CHAIRMAN.—Of course, so far as Mr. Frost is personally concerned, it is entirely proper that he should be heard, if he desires to be; but, so far as the case has developed, it does not seem to me that anything said of Mr. Frost affects, in any way, Mr. Shanly's claim.

Mr. TRAIN.—I do not think it affects the question at all, except

in one point of view, namely, that Mr. Shanly claims that he has been interfered with, to some extent, by the engineers.

Mr. ALLEN.—What claim is there? I do not understand that.

Mr. TRAIN.—That is the general impression he left on my mind, that he had not got on so advantageously with Mr. Frost as though he had had some other engineer to deal with.

Mr. ALLEN.—I should like to know if the Committee have the impression that he made any claim of that sort; my impression was that anything said of Mr. Frost had been said by me.

The CHAIRMAN.—Well, that is all I remember; and at the time the statements were made, they made an impression on my mind—especially the note from Mr. Laurie—that Mr. Frost was not managing the thing as he ought. But the case has seemed to take such a turn since that, that has become so entirely immaterial, as to pass altogether from my mind.

#### STATEMENT OF MR. FROST.

Mr. FROST then said: I have just one simple statement to make, and that is in regard to Mr. Laurie. I early discovered that he was acting entirely from interested motives. One of his main points was his attempt to show his devotion to the interests of the Commonwealth by cutting down the estimates of the contractors, and by proving that I had been dishonest in allowing the estimates, at the rates and on the basis which I had fully explained to the governor and council, acting alone, and under their instructions, before any consulting engineer was employed. He carried on that warfare for months, talking to the governor and council, without ever talking or explaining to me. Finally, he made the charge, before my assistants in the office, that I was suspected in the Commonwealth of corrupt complicity with the contractors. I told him then, distinctly, that he must put his advice in writing; that I had adopted my plan of estimates with the advice of the governor and council, and that I should not fall from it. He then varied his schemes, after having declined, month by month, when I requested him, to put on paper these charges. My associates, whom I consulted in the matter individually, the engineers, and the special members of the council who had taken cognizance of it, knew just what his claim was. All the time he talked to the council, he never explained the ground on which he impugned my conduct. When he was challenged, he brought forward a lot of petty details; and he brought forward one petty fact, out of which he would have embarrassed, seriously, the Shanlys, by withdrawing their monthly allowance. The things he brought forward were, in fact, so small



as to simply concern a matter of interpretation. That is all I have to say, and all I wished to contradict, at the first opportunity.

Q. By Mr. TRAIN.—Mr. Laurie was discharged afterwards?

A. Yes, he was, for that and other matters in which his personal motives were precisely similar.

Q. He complained of your allowances?

A. Yes, the general discussion which continued every month between us was, as to whether he should cut down Messrs. Shanlys' estimates, month after month, by several thousands of dollars. Then, he went on in the same way, as to my interpretation of small matters. Then he went into the question of lines, in which he certainly thought he could not be detected, and so he went on, month after month, until the council were very anxious, and so I said to them that I certainly thought my lines were correct, and that after Mr. Laurie had been shown by me that my lines only varied one quarter of an inch, he was not content, and would not be convinced. Then they came to the conclusion that some other engineer must be employed, and by that conclusion he was discharged.

Q. And subsequent events demonstrated your position in the matter?

A. Yes, sir, my lines were shown to be quite correct.

Q. You have heard Mr. Philbrick's testimony in regard to the character of the rock, and as to the influx of water. Do you agree with him?

A. Those are, substantially, my opinions.

The CHAIRMAN.—How does the suggestion, I made, gentlemen, strike you, about leaving this matter open until you have exhausted your efforts in the direction of arriving at some conclusion which you can bring to us?

Mr. ALLEN.—That is the position we thought it was left in the other day after the Committee adjourned.

The CHAIRMAN.—Well, what shall we do for you in the future? Shall we keep this hearing open until you have time to agree together?

Mr. ALLEN.—Mr. Shanly has not been able to ascertain how much he could get the brick for yet. He has made some applications to know the price of brick, and I should hope that he and Mr. Philbrick, on getting together and talking further, could arrive a little closer at how large an estimate is wanted. After that Mr. Shanly will ascertain how much he can do the work for; and Mr. Philbrick can say whether that is a reasonable price for doing it. I think that is the best course for the matter to take, as it stands now.

Mr. TRAIN.—Well, the Committee might adjourn, and after these consultations are concluded, if a result is come to, we will communicate with the Chairman.

The CHAIRMAN.—Then we will leave it that the Committee shall be called together whenever a result is reached, and a report of it ready to be made. I wish you would do so as soon as you can, for one reason: the Committee will visit the Tunnel, and if we can know exactly what we have to do about this thing before we go, we can devote as much examination to it as may be necessary when there.

Mr. ALLEN.—Mr. Shanly will be ready, so far as he is concerned, to arrive at a conclusion in a very few days; a week at the outside.

The CHAIRMAN.—Very well, then; we will let the matter stand over and I will call the Committee together whenever a report is ready to be made to it.

Adjourned.





# SENATE . . . . No. 150.

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## Commonwealth of Massachusetts.

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IN SENATE, April 27, 1875.

The Committee on Claims, to whom was referred the memorial of Walter and Francis Shanly concerning the Hoosac Tunnel,

### REPORT:

That in the carrying out of their contract for the construction of the Hoosac Tunnel, the Messrs. Shanly were compelled to do certain work which was not contemplated by either party at the time the contract was made; also that certain portions of the Tunnel were represented by the state engineers, and understood by both engineers and contractors, to be completed at the time the Shanlys entered upon the work, which afterwards proved not to be finished, and upon which these contractors were required to expend considerable sums of money.

It appears from the contract that the Messrs. Shanly were entitled to the use of the Haupt Tunnel, at the western portal, through which they removed excavated rock from the main Tunnel, and through which they also brought the material for building the façade over the portal. This Tunnel the State destroyed in making the cutting for a railroad to the western portal, and the Shanlys were put to extra expense in the prosecution of their contract thereafter.

The contractor's were also required to do certain grading, part of which was upon a highway, and seems clearly not to have been within the contract.

In driving the heading westward from the central shaft a large flow of water was met,—a difficulty which was unex-

pected to both engineers and contractors. By imperative orders from the state authorities (and in accordance with a literal construction of the contract), this heading was driven into the wet rock at a great loss to the contractors, and, until the completion of the whole work, was greatly endangered, when it was suspended until drainage could be obtained through the eastern portal.

The great storm of October 4, 1869, occasioned loss and delay by flooding the Farren Arch with debris, and carrying away and destroying portions of the Troy and Greenfield Railroad, and although this was a misfortune for which the State was in no way responsible, except so far as it might be held to be so by reason of the breaking away of an embankment built under its direction, still it seems to have been an unforeseen calamity of which the State might with justice bear a portion of the burden.

By the evidence of both the contractors and the state engineers, it appears that a large amount of rock outside of the contract lines has been removed by the Messrs. Shanly, and that this extra excavation will be of great advantage to the State in that portion of the Tunnel requiring to be arched. The value of this work to the State is estimated all the way from \$113,190 to \$250,000, the first-mentioned sum being the lowest estimate.

From the evidence given in the case, it will be seen that the contractors have suffered a loss of \$226,000 on their whole contract; that they have pursued the work with great energy, and brought it to a successful completion in the face of the most discouraging obstacles. For these reasons, which more fully appear in the evidence printed herewith, a majority of the Committee submit the accompanying Resolve.

GEORGE L. DAVIS,  
H. M. ROBINSON,  
DANIEL J. LEWIS,  
J. A. CUMMINGS,  
AMOS B. HOLDEN,  
LUTHER FISK,  
SAMUEL ALLEN,

*Majority of Committee on Claims.*

## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Five.

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### RESOLVE

In favor of Walter and Francis Shanly.

*Resolved*, That there be allowed and paid out of the treasury to Walter and Francis Shanly the sum of one hundred and twelve thousand dollars, in full settlement of all claims on account of the construction of the Hoosac Tunnel.



## Commonwealth of Massachusetts.

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### MINORITY REPORT.

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IN SENATE, April 27, 1875.

A minority of the Committee on Claims, to whom was referred the memorial of Walter and Francis Shanly, concerning the Hoosac Tunnel,

### REPORT :

The undersigned are of the opinion that the petitioners ought to be reimbursed by the State for the full amount of their loss in the construction of the Hoosac Tunnel ; namely, \$226,495, with interest after January 1, 1875.

The following reasons seem to them to lead to this result :—

It is admitted that various items mentioned by the Messrs. Shanly for extra work, for error in the original measurement of Tunnel rock, and for damages arising out of the storm of 1869, ought to be paid. These amount to about \$60,000, without interest ; if these claims are just, reasonable interest should be allowed upon them, and this will amount to something over \$12,000 more.

After referring to these items, the petition goes on to state that the contract has proved, not only unremunerative, but has resulted in a heavy loss to the contractors, and asks that, in view of the many difficulties, which it was impossible to anticipate fully, or provide for, the legislature will appropriate a sum of money to compensate them for their loss in carrying out this great undertaking. The cause of their

heaviest loss, they say, was from the great flow of water which was encountered in working westward from the central shaft, and from the requirement of the state authorities that they should prosecute these westward workings at all hazards, in the face of this water, contrary to the dictates of their own judgment.

When this water was first met with, the contractors proceeded as fast as possible to put in a series of large pumps, with a view of pumping out all the water that should come in from the seams already struck, and suspending further work to the west, but proceeded with all possible despatch to join the eastern headings, so as to give drainage for the water, after which they could proceed west without danger.

There can be no doubt that the contractors were anxious to push the work as fast as possible, and thought this the best and most expeditious way of doing it. But the engineers of the State advised that they should be required to drive the heading west from the central shaft, and, acting under imperative orders, issued with a threat of stopping the payments unless the orders were obeyed, the contractors resumed that work; but the water increased so fast that it was finally absolutely necessary to desist. The extra expense to the contractors from attempting to obey these orders was over \$200,000.

The undersigned are of the opinion that the judgment of the contractors was right, and has been clearly vindicated by the result. If they had been allowed to pursue their own course, they would, by working on three faces alone, have completed the penetration of the mountain within less than three months of the time calculated on in the contract, so that there would probably have been no occasion to extend the time at all for the full completion of the Tunnel, or at any rate only for a few weeks. The contractors were pushing forward the work at all other points much faster than the contract required. The committee for 1871, in their report made at the beginning of 1872, report that the workings at both the east and west ends were already in advance of the points required by the stipulation of the contract, and that the rate of progress then prevailing at the east end was more than twenty-five per cent. in excess of the contract rate.

During the year 1872 they also exceeded the contract rates in the east end; and in the west headings, and in working east from the central shaft, the excess amounted to thirty-three per cent. The rates of progress actually made by them are the best test to show how small would have been the delay in the whole work if they had been allowed to follow out their own course. But the contractors were in that position that they could not help themselves; they had \$500,000 of money in the hands of the State, which would be forfeited if they threw up their contract; their estimates would be stopped unless they followed the orders which were given; and so, after repeated protests and remonstrances, they undertook to go on, with the result that has been stated.

The petition further sets forth that the contractors have made a larger Tunnel than their contract required them to make, and that this increased size will be a direct saving to the State wherever it may be decided that additional arching is required.

Mr. Frost, the state engineer, testified before us that he had made a computation of the number of cubic yards of rock which the contractors had taken out, outside of the prescribed area of the Tunnel, and estimated it at 22,638 cubic yards, in those portions of the Tunnel which must be arched (according to the opinion of three of the State's experts), and that this would save the State \$250,000, at the prices allowed in the contract for doing that kind of work. Afterwards, at the meeting of the Committee at North Adams, he put the saving at \$220,000; and still later sent in a letter saying he thought if the Messrs. Shanly had done none of this work Mr. Farren would only have charged \$8 per cubic yard instead of \$10, which he now gets; and that if this was so, the saving to the State would be \$113,190. It does not seem reasonable to suppose that the addition of 22,000 cubic yards of excavation would make so much difference in the price. The lowest price fixed in the Shanly contract for much larger amounts of work was \$9 per cubic yard. Without going into too great nicety of calculation, it appears that at the lowest estimate the State will save \$113,000 from this additional work done by the Messrs. Shanly, and probably a very considerable sum more.



It further appears to our satisfaction that during the prosecution of this work the course of the engineers of the State towards the contractors was not such as the latter were entitled to expect. Particular instances might be given, and may be found in the testimony. Mr. Shanly was questioned upon this point, as follows (see page 264) :—

“ Q. Did you have the feeling that the engineers were working in coöperation and sympathy with you, or working against you ?

“ A. I think the whole contract was always interpreted against us in the severest possible terms. I would prefer not to have had the question asked me, but as it has been asked, I will answer it. I always felt—I always was made to feel—this : ‘ You have got to follow that specification. Fail in the Tunnel, if you will ; but if you do, you must not fail in carrying out the specification.’ That was what was always dinned into me. ‘ You must follow that specification, even if it should be destructive of the ultimate progress of the Tunnel.’ ”

On the whole, the contractors have performed their work faithfully. They have received the praise of every successive committee of the legislature, during their whole contract. They are entitled to great credit for their energy and persistency in carrying on the work under very discouraging circumstances. They have shown the highest good faith and integrity in all their dealings with the State. No one has raised any question of this. The contract has certainly proved far more onerous to them than was or could have been anticipated at the time it was entered into ; it has also been made unnecessarily expensive to them. Under these circumstances, the State should not be willing to permit them to be actually out of pocket, as a result of their successful prosecution of this undertaking. If compelled to submit to a loss, the contractors will have just reason to feel that they have not been fairly dealt with by the State.

We therefore recommend the passage of the accompanying Resolve.

FRED’K P. MOSELEY,

A. M. COPELAND,

*Of the Committee on Claims.*

## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Five.

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### RESOLVE

In favor of Walter and Francis Shanly.

*Resolved*, That there be allowed and paid out of the treasury to Walter and Francis Shanly the sum of two hundred and twenty-six thousand four hundred and ninety-five dollars, with interest at the rate of five per cent. after January first, eighteen hundred and seventy-five, on account of their loss in the construction of the Hoosac Tunnel.

## Commonwealth of Massachusetts.

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### DISSENTING REPORT.

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IN SENATE, April 27, 1875.

The undersigned, one of the Committee on Claims, to whom was referred the petition of Walter and Francis Shanly, wherein they present certain claims for work done outside of their contract for completing the Hoosac Tunnel, and also for delays and damages sustained by them from causes not within their control, as they allege, amounting in all to the sum of \$131,681.50, and consisting of ten items, a schedule of which is annexed to their petition, is unable to agree to the report of the majority of the Committee, but submits the following

### R E P O R T :

The first item of their claim is for the sum of \$3,582.20, for enlarging the Tunnel for the first eight hundred feet from the east portal. The Messrs. Shanly seem to have entered into their contract with the Commonwealth fully understanding that the Commonwealth were in no event to be responsible for the correctness of the estimates given of rock, or of the specific work to be done, so as to relieve the contractors, in case the estimates should prove erroneous in any respect, from the obligation of their contract, which was for a full and complete performance of the entire work required for the completion of the Hoosac Tunnel. And on the other hand,



no errors in the estimates could in any way affect the gross amount to be paid by the Commonwealth to the contractors, as fixed by the contract. But in regard to this first item, I am satisfied from the evidence that the Messrs. Shanly considered this eight hundred feet as finished when they took the contract; but that in fact, although the rock had been bored to about its full size, yet it needed some trimming, and this work was done by the Messrs. Shanly, they protesting, however, that it was not called for under their contract, and that they had nothing to do with it, and should expect extra pay for it. The sum claimed for this work is not unreasonable, and, I think, on the whole, this item should be allowed.

The second item is for grading embankments at the east end of the Tunnel. The contractors were to deposit material excavated when directed within three thousand feet from either end of the Tunnel. The state engineers, however, after the material had been dumped, required it to be levelled to a particular grade. This the Messrs. Shanly objected to, and did it under protest. I am not satisfied that the contractors were by their contract bound to conform to the grade required by the engineers, and at all events the rehandling of the material involved much extra labor and expense. The regrading cost the Messrs. Shanly \$3,511.18, and that sum I think should be allowed them.

Item third is for making a central drain from the east portal, \$8,694.23. It was claimed on behalf of the Commonwealth that the contractors ought to have examined for themselves and ascertained that the central drain, at the time they took the contract, was properly constructed; and so that any extra expense to which they were subjected in clearing out, deepening and altering this drain, should fall upon themselves. But I think on the evidence that they were justified in believing that no work would be required on this drain. Not only the contractors, but the state engineers as well, seem to have understood that this drain was properly constructed. Furthermore, it was so covered up by stones and plank that a proper examination could not really be made. It turned out, after the Messrs. Shanly began work, that a portion of the drain was not laid at all, and what was laid had to be deepened a foot. This was done by the Shanlys at

the cost named in this item of their claim, and I think it should be allowed.

Item four. Increased working expenses because of the destruction of the Haupt Tunnel. Agents of the Commonwealth destroyed this Tunnel, perhaps unintentionally, or without fault, but this destruction deprived the contractors of the use of this Haupt Tunnel, and, in consequence, they had to hoist out material instead of drawing it out by cars through the Tunnel. It was claimed that this Tunnel was not destroyed until after the time within which the contractors ought to have finished their contract, but they obtained from the governor and council an extension of time of six months. During that time the Tunnel referred to was closed up. I think the contractors might legitimately have counted upon the use of that Tunnel during that six months, and I accordingly report in favor of the allowance of this item.

Item fifth is a claim for \$22,246 for taking down loose rock after the Tunnel had been trimmed. This was a contingency clearly within the scope of the contract,—something which the contractors might reasonably have anticipated,—and which I think they were bound to do under their contract. They took the chances of the kind of rock which they might encounter, and I think the quantity of loose rock not more than might have been taken into consideration in making the contract. Certainly the Commonwealth could not be called upon to guarantee the kind of rock under each part of the mountain. I think this item should be disallowed.

Sixth. Clearing out the Farren Arch. This work arose out of the great storm of 1869. The Commonwealth has already, in its dealings with the railroads operating the Troy and Greenfield Railroad, treated the consequences of this storm as results of something not ordinarily to be foreseen. It has compensated those corporations for losses sustained from the extraordinary character of this storm and freshet. The cost incurred by the Messrs. Shanly from the same occurrence was \$1,350, and I think this sum should be paid them.

Seventh. Errors in original measurement of the Tunnel rock to be excavated, \$21,977.50. It is true that there were errors in the measurement of some portions of the Tunnel which were against the Shanlys; that is to say, would mislead

them in their estimates, if they adopted the measurement contained in the schedule annexed to the contract. Yet, I am of opinion that other and greater errors were made which worked in their favor, the quantities given by the engineers being in excess of those actually excavated. For this reason, and without pressing on the question argued at the hearing, whether the Shanlys took the risk of gain or loss from incorrect measurements, I think this item not a valid claim against the State. The Shanlys on the whole appear to me to have profited by the errors.

Eighth. Damages arising out of storm of 1869, \$18,000. These damages, I think, were actually sustained, and, for reasons already given, I think should be allowed.

I can see no principle or ground, legal or equitable, for allowing the items nine and ten, for interest. I cannot believe that any money was withheld from the contractors after satisfactory evidence had been presented to the governor and council that it had been earned, nor do I see any reason for the opinion that the State has not, in its dealings with the contractors, acted, not only fairly, but even generously. The onerous obligations of the contract were waived by special legislation, and the smallest percentage of the payments consistent with safety to the State was reserved in the treasury.

I have gone over all the items of the claims contained in the schedule annexed to the petition and referred to the Committee. I believe I argue with the majority in respect to the validity of the claims, which I think should be allowed, and the invalidity of the others. But the majority propose to pay an additional sum to the Messrs. Shanly, on account of a benefit which it is said the State derived in that portion of the Tunnel requiring to be arched, from the removal by the contractors of a large amount of rock outside of the contract lines. It might be sufficient to say that, while the fact was stated in the petition, it was not made a subject of claim; but the statement and the fact, so far as proved, seem to have been put forward as a reason why the State could afford to pay the claims actually presented, if there should be no legal ground on which to rest them.

There is no evidence that the contractors were required by



the engineers to excavate beyond the Tunnel lines, excepting they were required to take down loose rock to make the Tunnel safe after it had been excavated to the original Tunnel lines. Mr. Shanly testifies (see page 47 of the Senate Doc. 150) that some of the excavations outside of the Tunnel lines were what contractors should expect, and some of the others were made for his own convenience, intentionally. A question has heretofore arisen between the contractors and the state officials whether the contractors were not only required to excavate beyond the original Tunnel lines, but were also bound to arch all the Tunnel where the rock was not self-sustaining, and the matter was brought before the last legislature, which, by an Act (chap. 365 of 1874), relieved the Messrs. Shanly by making a special appropriation for the arching. I infer this was intended as a settlement of the question; but whether that be so or not, I cannot see how the contractors have any foundation for a claim against the State for excavations beyond the original Tunnel lines.

The contract required the contractors to leave "the Tunnel and railroad track in complete order ready for use." It was a contract for the whole work for a round sum. It seems to me that a compliance with the contract required the performance of some labor besides the mere excavation, either of additional removal of rock or of arching, and that the Commonwealth has derived no benefit from the additional removal of rock, other than it had a right to expect from a performance of the contract. Nor do I see how the contractors can have any claim upon the Commonwealth, legal or equitable, from the fact that the engineers held the contractors up to the strict compliance with their contract.

I cannot, therefore, as a member of the Committee on Claims, report a claim is made out for any sum of money legally or equitably due from the Commonwealth beyond the items already stated. Any additional sum, if any be appropriated, must be regarded as a gratuity or donation in the widest sense of the term. I therefore report the accompanying Resolve.

ISAAC PRATT, JR.,

*One of the Committee.*

## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Five.

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### RESOLVE

In favor of Walter and Francis Shanly.

*Resolved*, That there be allowed and paid out of the treasury of the Commonwealth to Walter and Francis Shanly the sum of thirty-seven thousand eight hundred and thirty-seven dollars and sixty-one cents, in full of all their claims, legal and equitable, against the Commonwealth, arising out of work done or losses incurred upon or in connection with the Hoosac Tunnel and its approaches.







# HEARING

BEFORE THE

## COMMITTEE ON CLAIMS

ON THE

PETITION OF W. & F. SHANLY,

FEBRUARY AND MARCH, 1875.

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BOSTON:  
WRIGHT & POTTER, STATE PRINTERS,  
79 MILK STREET (CORNER OF FEDERAL).  
1875.





# P E T I T I O N .

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*To the Senate and Representatives of the Commonwealth of Massachusetts,  
in General Court assembled:—*

The undersigned, Walter & Francis Shanly, lately contractors for the Hoosac Tunnel, respectfully represent that they have completed their contract, and that shortly previous to the beginning of the present year,—namely, the 22d of December, 1874,—they handed over the work to the state authorities: That in settling accounts with His Excellency, acting Governor Talbot and the Honorable Council, certain claims for work done outside of the contract, and for delays and damages sustained from causes not within the control of your petitioners, etc., etc., were left unadjusted as not within the power of the Executive to deal with, but were at the same time characterized as “equitable claims,” for the granting of which your petitioners would have to apply to the legislature: That the claims in question, and the allowances asked for, amount in the aggregate to \$131,681.51, as set forth in detail in the schedule appended hereto, and are all for moneys actually disbursed in furtherance of the work, though not contemplated by the contract, or incurred in connection therewith, through unforeseen circumstances, accidents or extraneous necessities. That among the claims in said schedule is one for damage and loss occasioned by the extraordinary rain-storm of 4th October, 1869, which caused the inundation of the Tunnel and consequent stoppage for a time of the works at the west end, and the destruction, in part, of the Troy & Greenfield Railroad, cutting off your petitioners for nine months from rail communication with their works east of the mountain.

An item also appears in the schedule under the head of “loss of interest since 1st September, 1874.” This arises from the petitioners having been deprived of means of exit at the west portal during more than four months, delaying the completion of their work for that period of time, by the destruction—unavoidable destruction, doubtless—of what was known as the “Haupt Tunnel,” by order of the state authorities. Your petitioners were subject all that time, as for long before, to an interest liability of upwards of \$140 per day.

The last item in the schedule, \$31,620.40, “remission of interest paid to state,” is not claimed—not all of it, at least—as their due by your petitioners, but is asked under the pressure of necessity towards extricating themselves from heavy liabilities incurred in completing their contract in the face of many unlooked-for obstacles. The interest as paid in the recent

settlement (22d December last), was, by the treasurer of the Commonwealth, calculated down to that date. Under any circumstances, your petitioners hold it should not have been brought down below September 1st, by which date their work would have been finished, but for the detention at west portal herein above referred to.

The other items in the schedule, going to make up the total of \$131,-681.51, are of kinds requiring detailed explanations which your petitioners believe can best be made before such committee as the general court may see fit to refer these matters to.

Your petitioners further beg leave to represent that their contract for the Hoosac Tunnel has proved, not only unremunerative, but, after close upon six years of application and anxiety, has resulted in a heavy pecuniary loss, and that even if allowed the full amount of the schedule above mentioned, they will still find themselves losers to an extent of not very far short of \$100,000. They are fully aware that the contract leaves no opening to claims for remuneration for losses legitimately incurred, and that the chances of loss or gain from the undertaking were at the contractors' own risk; but they believe, nevertheless, that upon looking dispassionately into the whole matter, the people of Massachusetts, as represented by the legislature, will not be inclined to construe the contract too strictly, but considering the many difficulties, not alone unforeseen, but impossible to have been fully anticipated or provided for, will be willing to appropriate such a sum, in the form of a *bonus*, over and above the contract amount of \$4,594,268, as will, in part, at all events, compensate the contractors for the carrying out of a work like the Hoosac Tunnel, taking rank, as it does, with the great undertakings of the world.

The cause of the heaviest loss to the contractors was in the central-shaft workings, where, early in 1871, a great and unlooked-for accession of water in the westward heading, warned them that the proper course would be to suspend operations in that direction until an outlet could be effected eastward of the shaft. The engineers and state authorities, generally, decided otherwise, and insisted, under pain of non-payment of the estimates, that the westward workings should be prosecuted at all hazards. Your petitioners, consequently, and contrary to the dictates of their own judgment, continued to work westward as commanded, until, from the vast quantity of water encountered, it became evident that further persistence in that course must inevitably result in the filling of the shaft, and the consequent abandonment of all work either way therefrom, if not of the Tunnel altogether. The contractors were then tacitly permitted to suspend operations westward, but not until the flow of water had become such as to impose additional expenses and loss upon them, in the future prosecution of the central-shaft workings, of not far short of \$200,000.

Your petitioners would respectfully suggest that, in consideration of the above facts, interest might be allowed them upon all drawback retained from moneys earned by them in the progress of the work: such drawback from the commencement of the contract until July, 1873, having been at the rate of twenty per cent. on each monthly estimate; subsequent to which date it was by Act of the legislature of that year limited

to \$350,000 in the aggregate;—but as a matter of fact, much more than that amount was kept back, until at the completion of the work, or to within a month of its completion, the drawback actually amounted to upwards of half a million of dollars. Interest on all drawback calculated at five per cent. would amount to about \$85,000, which, if allowed, would put your petitioners about square as regards receipts and expenditure.

Your petitioners would also direct attention to the fact that they have made a larger Tunnel than the contract required them to make; that is to say, have given it a greater area than was prescribed by the specifications; and that such increased size is just so much work done towards preparing for arching, wherever it may be decided that additional arching is required. The actual money-value of the work done in this way will be found to be not far below \$50 per foot of Tunnel so dealt with. In other terms, the cost of arching will be that much less per foot than if the petitioners had taken the Tunnel out to the prescribed lines, and no more.

The Commonwealth of Massachusetts having, as already observed, now become possessed,—and in part, at all events, through the agency of the undersigned,—of one of the great engineering achievements of the age, your petitioners are slow to believe that, on full consideration of all the circumstances of the case, the State will take the benefit of the extra dimensions given to the Tunnel,—valuable, wholly apart from the arching question,—and allow nothing for it.

All which is respectfully submitted,

W. SHANLY.  
F. SHANLY.

Boston, January 11, 1875.



## SCHEDULE

REFERRED TO IN PETITION OF W. &amp; F. SHANLY.

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1. Enlarging Tunnel first 800 feet from east portal, . . .	\$3,582 20
2. Grading embankments at east end, . . . . .	3,511 18
3. Making central drain 5,017 feet from east portal, . . .	8,694 23
4. Increased working expenses because of destruction of Haupt Tunnel, . . . . .	2,700 00
5. Taking down loose rock after Tunnel had been trimmed, . . .	22,246 00
6. Clearing out Farren arch, . . . . .	1,350 00
7. For errors in original measurement of Tunnel rock, . . .	21,977 50
8. Damages arising out of storm of 4th October, 1869, . . .	18,000 00
9. Loss of interest, before and since 1st September to 22d December, 1874, . . . . .	18,000 00
10. Interest paid State on advances from drawback, . . .	31,620 40
	<hr/>
	\$131,681 51

## HEARING ON THE SHANLY PETITION.

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[The testimony of Mr. Shanly, on February 10 and March 3d, was not taken phonographically, but the substance of it is here given.]

FEBRUARY 10, 1875.

WALTER SHANLY. When we were about taking the contract, the first 810 feet at the east end were represented as finished, and it was so treated for two or three years, when we were directed to trim this part of the Tunnel. We claimed it was not in our contract, and charged for the work just what it cost us.

[He referred to the Commissioner's Report, House Doc. of 1869, No. 192, p. 28; and to the Engineer's Report, appended, p. 58, to show that this part was then regarded as finished.]

By our contract, we were to deposit the material excavated, where directed. We were to put it as nearly on a level as we could dump it. We got it singularly near. After getting this done, we were instructed to grade it, for the railroad embankment in one place, and for a county road in another place. We claim we were not required to grade the rock after we had dumped it, and that the contract requires us simply to deposit the material.

We were to make a central drain in the Tunnel. The length is specified in the contract. When we begun it was assumed as a completed drain for about a mile. It was so described to us. It was covered with a wooden covering. It all had to be sunk about a foot deeper.

[A letter of Messrs. Shanly to Mr. Frost, and Mr. Frost's reply, were read as follows:—]

(Copy.)

NORTH ADAMS, August 7, 1874.

DEAR SIR:—As far as we have yet uncovered the central drain, east of 4800, eastern section, we find it all too high in the bottom,—so much too high as to require a great deal of labor to bring it to the proper grade; and it will take all the force we now have at east end to complete it, ready for the drain-pipe, by latter part of this month,—that is, provided it all proves to be as much above “grade” as what we have already uncovered. This work, being outside of our contract, we shall charge as an “extra” to the State.

Yours truly,

(Signed,)

F. SHANLY &amp; CO.

BENJ. D. FROST, Esq., &amp;c., &amp;c.

ENGINEER'S OFFICE, HOOSAC TUNNEL, }  
NORTH ADAMS, MASS., August 13, 1874. }

MESSRS. F. SHANLY & CO.:—In reply to your note of August 7, concerning the trench for central drain in east end section, extending eastward from station 4800, which you mention to have been left too high (by the state force previous to your contract), and consequently to require further work of excavation to take the bottom down to proper grade,—

I recognize that your understanding, and my belief, also, at time of making your contract, regarded this length of trench as having been excavated to proper grade.

I am not, however, authorized to entertain and decide equitable considerations, which belong to conditions existing at the time of execution of your contract. For such an item as this I think you should transmit me a statement of cost, as soon as made up, for each month. My attention will thus be called to these, to examine and verify them by aid of my own returns, and they may be recorded so as to submit them at the time of final settlement of your contract.

Yours respectfully,

BENJ. D. FROST.

The access to the west portal of the Tunnel was through the Haupt Tunnel only. When we took the contract, the Haupt Tunnel was full of debris. It was put into our contract that we were to keep it open. We had the use of it till about a year ago. The work of constructing the railroad from North Adams to the Tunnel necessitated the destruction of the Haupt Tunnel. Some efforts were made to avoid it, but they were unsuccessful. We had to put up steam-works.



[Mr. Frost's letters of February 11, 1874, and March 7, 1874, were put in.]

A fall of rock occurred about the middle of February, in consequence of building the railroad. It was a necessity on the part of the State to destroy the Haupt Tunnel, but it was an interference with our rights.

The increase of actual working expenses to us was a little over \$2,700.

We were required to go over the whole Tunnel and trim it nicely. We went to great expense, probably \$110,000, in doing it. Afterwards, it was found that some rock was loose. We were told to go over the whole Tunnel and take down all the rock that was loose. We hold, after we had trimmed the Tunnel to contract size, our work was done. We took down rock where we might have to go to the top of the mountain. We had completed the Tunnel to the dimensions given to us, before receiving this order.

The Farren arch, so called, was made by Farren, mostly before our contract. Our contract says that our work is exclusive of Farren's. The great storm of October, 1869, amongst other damages at the west end, almost completely filled in the Farren arch. The State paid us some \$3,300 for doing the work of restoration after that storm, which we accepted as on account only. This item of \$1,350 was for the balance of the work, and was done last September or October.

The contract price was arrived at by taking the estimates of the engineer of the quantity of the Tunnel rock. It turned out afterwards that the estimates were not correct. Mr. Laurie called our attention to the fact that the measurements were incorrect. He was then consulting engineer for the State.

[Mr. Laurie's statement, in Senate Doc. of 1871, No. 283, p. 32, was referred to.]

After the storm of October 4, 1869, everything required for use at the east end of the Tunnel had to be dragged over the mountain. We were prevented from the use of the rail-

road about nine months. The item of \$18,000 includes all the nameless losses and inconveniences to us. We are sure this is not too large.

By the loss of the Haupt Tunnel we were delayed a long time. We were blocked at the west end. We have been under an interest expense of \$140 a day for five years. We claim that this expense, during the time we were delayed, was a direct loss, on account of the destruction of the Haupt Tunnel.

The item for interest paid State on advances from draw-back arose thus: The State was authorized to retain from us twenty per cent. of the estimates of our earnings. We found this burdensome, and applied for relief. The legislature passed a Resolve that only \$350,000 should be retained; but the amount advanced to us was incumbered with interest, which we paid.

That is the last item that was formulated in our petition.

Our contract was unsuccessful. There were great difficulties.

[The attorney general here asked that the detailed accounts going to make up all these items should be furnished for examination to Mr. Frost, and Mr. Shanly agreed to furnish them.]

When we took this contract in the first instance, printed tenders were furnished. We made an item bid. Then the governor wished us to make a contract for a bulk sum.

The principal loss we sustained was in the workings from the central shaft. We struck rock very different from what was supposed. Water came in, some 300 feet west of central shaft. We determined that the true policy was to cease working in that direction (this was in November, 1871), and turn all our force eastward. We suspended work westward. But the governor and council ordered us to proceed, water or no water, and if we did not we should not have payment of our estimates. We went on, and stopped again in February, 1872. Again an order came for us to go on; we went on, and stopped again. It was an utter impossibility to go on. We stopped till there was a hole through to

the eastward. This cost us over \$200,000. We could have finished the Tunnel some months sooner, if permitted to follow our own plan. It would have saved us over \$200,000, and we would have finished the Tunnel some months sooner. We gained nothing by going on, because we made only 100 feet of progress, and the loss to us was enormous. Putting that loss with others, and even if all the items annexed to our petition are allowed, our losses will be from \$70,000 to \$100,000. Our books are not fully made up yet.

[A copy of the "specifications," issued by the State in 1868, and of Messrs. Shanly's tender, was put in. Also the following schedule, showing how the contract price was arrived at.]



## HOOSAC TUNNEL.—Schedule of Rates agreed upon as Basis of Contract.

DENOMINATION OF WORK.	Quantities.	Prices.	Amounts.	Totals for each Section.
<b>EASTERN SECTION.</b>				
Tunnel Enlargement, per cubic yard, . . . . .	4,500	\$16 00	\$72,000 00	
Heading Enlargement, per cubic yard, . . . . .	28,000	9 00	252,000 00	
Full-sized Tunnel, per cubic yard, . . . . .	85,100	11 00	936,100 00	
Central Drain, with pipes, per lineal foot, . . . . .	5,600	13 00	72,800 00	
Track, per mile, . . . . .	2	14,000 00	28,000 00	
Covering part of drain already made, lineal feet, . . . . .	5,500	1 25	6,875 00	
				\$1,367,775 00
<b>CENTRAL SECTION.</b>				
Replacing Timbers in Shaft, already sunk, per lineal foot, . . . . .	583	\$10 00	\$5,830 00	
Sinking Shaft to full depth, per lineal foot, . . . . .	447	395 00	176,565 00	
Pipes in Shaft, 2 ft. 10 in. diameter, each, per lineal foot, . . . . .	1,030	6 00	6,180 00	
Sinking Sump, per lineal foot, . . . . .	15	395 00	5,920 00	
Tunnel Excavation, per cubic yard, . . . . .	82,270	14 00	1,151,780 00	
Central Drain, with pipes, per lineal foot, . . . . .	5,158	13 00	67,054 00	
Track, per mile, . . . . .	1	14,000 00	14,000 00	
Trimming Shaft where out of line, cubic yards, . . . . .	100	33 00	3,300 00	
				1,430,629 00

## WESTERN SECTION.

Heading Enlargement, per cubic yard, . . . . .	.	.	.	.	.	\$9 75	\$514,800 00
Tunnel, full size, per cubic yard, . . . . .	.	.	.	.	.	12 00	995,280 00
Brick-work, per thousand, . . . . .	.	.	.	.	.	22 00	99,000 00
Central Drain, with pipes, per lineal foot, . . . . .	.	.	.	.	.	13 00	88,517 00
Central Drain, without pipes, per lineal foot, . . . . .	.	.	.	.	.	4 35	6,594 00
Central Drain, in invert, per lineal foot, . . . . .	.	.	.	.	.	3 00	4,548 00
Track, per mile, . . . . .	.	.	.	.	.	14,000 00	24,500 00
Covering Drain, already made, per lineal foot, . . . . .	.	.	.	.	.	1 25	3,125 00
							\$1,736,364 00

## ADDITIONAL WORK—CENTRAL SHAFT.

Iron Fire-proof Hatches to Shaft, . . . . .	.	.	.	.	.	—	\$2,000 00
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## ADDITIONAL WORK—WEST END.

Stone Arch, adjoining brick-work, . . . . .	.	.	.	.	.	—	\$23,000 00
Facade, . . . . .	.	.	.	.	.	—	26,000 00
Haupt Tunnel (clearing out, etc.), . . . . .	.	.	.	.	.	—	8,500 00
							57,500 00

Total actual amount of Contract, . . . . .	.	.	.	.	.	.	\$4,594,268 00
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[Reference was made to various documents, for the purpose of showing that when the contract was made no large amount of water was expected.

Report of legislative hearing in 1854, Pres. Hitchcock's testimony. Report of John W. Brooks and others, commissioners, in 1863, p. 54. Report of Benj. Latrobe, Senate Doc. of 1869, No. 6. Report of commissioners, House Doc. 1869, No. 192.]

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MARCH 3, 1875.

W. SHANLY, resumed, and sworn. My statements at former hearing were all true.

I have furnished to Mr. Frost a detailed statement of how all the first six items are made up.

Mr. Frost furnished me diagrams, May 26, 1869, showing the work to be done. These diagrams began 800 feet west of the east portal. The details furnished to Mr. Frost, of work done on this part of the Tunnel, were taken from our books, kept in 1871. This item includes nothing for interest.

Mr. Frost furnished a diagram for the embankment, in September, 1873, showing what work was to be done. [Frost's letters and replies were put in.] We have not been allowed anything, except \$600 for work near the bridge, which does not apply on this, here charged for.

Of the central drain, 5,017 feet were assumed to be completed. Of this, 201 feet were untouched, and 4,816 feet only partially done. [A "comparative statement of work required by contract," Sen. Doc., 1870, No. 58, p. 12, showing same sums as the schedule above printed, was referred to.]

The last time we used the Haupt Tunnel was in February, 1874. The work remaining to be done September 1, 1874, was only about \$50,000, as shown by our pay-rolls since; this was exclusive of laying the track. We did not get an exit at west end till September 14, 1874. The west shaft could not be closed till then.



At time of making contract, we relied on measurements of the engineers, and could not make them ourselves. It would have taken a month. [Mr. Laurie's letter to Messrs. Shanly of January 30, 1871, was put in, showing that there was, in excess of the assumed quantities,—

1,353 yards solid rock, average \$12, . . .	\$16,236 00
4,448 " loose " . . . . .	5,741 50
	<hr/>
	\$21,977 50]

Since the last hearing, I have got from Mr. Frost a diagram of the Tunnel, and calculated the section, and, as a result, have to reduce that item by about \$10,000. According to this diagram, Laurie's statement is incorrect, and Frost's is incorrect. It is a matter of pure mathematics. The true measure of the excess is 433 yards of solid rock; and the loose rock remains the same.

The damages from the storm of October, 1869, are shown by the following statement:—

#### GREAT STORM OF OCTOBER 4, 1869.

##### *West End of Tunnel.*

Work done by W. & F. Shanly, in removing debris

and repairing water-course, etc., . . . . .	\$6,847 23
Received on account, January 23, 1872, . . . . .	3,305 19
Balance claimed as due, . . . . .	<hr/> \$3,542 04
Work done in clearing out the Farren arch, by Hocking &	
Holbrook, sub-contractors for W. & F. S., . . . . .	4,059 00
Sundry subsequent work on water-course, by W. & F. S., . . . . .	211 13
	<hr/>
Actually expended and still unpaid, . . . . .	\$7,812 17
The work in the Tunnel had to be suspended during nearly all	
the remainder of October, causing very considerable loss to	
the contractors, and in interest alone a loss of about . . . . .	2,000 00
Whole amount claimed by contractors as due them for west-	<hr/>
end losses consequent on the storm, . . . . .	\$9,812 17

The contractors have always held the State to be liable to them for all damages sustained by them at the west end of Tunnel from the above cause, or from any cause where the care of the Farren arch was involved, that being specially excepted from their contract.

*East End.*

The losses suffered at the east end of Tunnel were nearly all due to the destruction of the railroad between Greenfield and the Tunnel, leaving them without railroad communication with that side of the mountain for nine months,—namely, October, 1869, to July, 1870,—and so compelling them to transport everything required for the east-end work over the mountains from North Adams; even a locomotive engine had to be hauled over. Their greatest loss, however, was in not being able to obtain coal wherewith to work their steam machinery, erected at large outlay, to supplement insufficient water-power. The losses from above causes were,—

1st. Transportation over mountain, . . . . .	\$2,112 00
2d. Loss of use of steam machinery, causing the heading progress to fall off from its average about 80 feet from January to April inclusive, while labor expenses remained the same,—say 560 cubic yards of rock, at \$11 per yard, . . . . .	6,160 00
3d. Expenditure on water-course and removing debris, etc., . . . . .	850 00
	<hr/>
	\$9,122 00

The east-end damages are not claimed by the contractors as a right; but they think that, under the extraordinary circumstances of the case, and in view of the action of the State towards other sufferers from the same cause, their case may equitably be considered.

## RECAPITULATION.

West-end damages, . . . . .	\$9,812 17
East-end “ . . . . .	9,122 00
	<hr/>
	\$18,934 17

W. &amp; F. SHANLY.

MARCH 2, 1875.

The water-power of Deerfield River dam being insufficient, we had to put in steam-works, costing \$18,000 at the outset, and \$10,000 more for extra expenses of working.

I have prepared a statement as to interest, as follows:—

## ITEM 9.

*Interest on moneys claimed as due before and since September 1, 1874.*

Total amount of contract, was . . . . .	\$4,594,268 00
To Sept. 1, amount earned per estimates, was . . . . .	4,284,557 00
	<hr/>
Amount then behind or not earned, . . . . .	\$309,711 00
And also the security money, . . . . .	350,000 00
	<hr/>
Total amount back September 1, . . . . .	\$659,711 00

To have completed the contract work of Tunnel, except the track, would have required about .	\$50,000 00
And had the work been taken off contractors' hands on 1st September, doubtless same de- duction for track not laid, etc., would have been made then as was made on 22d December,	36,547 00
And interest due the State (\$31,620 on 22d De- cember), would then have been but about .	25,000 00
	<hr/>
	\$111,547 00

Had they not been hindered, the contractors hold that on 1st September they would have been in a position to claim payment of . . . . .	\$548,164 00
[Interest items,—No. 1.] Interest on which is claimed from 15th September to 15th October, on which latter day they received . . . . .	33,900 00

Leaving still behind on 15th October, . . . . .	\$514,264 00
[No. 2.] Interest on which is claimed from 15th October to 15th November, when they received . . . . .	81,000 00

Leaving behind on 15th November, . . . . .	\$433,264 00
[No. 3.] Interest on which is claimed from 15th November to 15th December, when they received . . . . .	20,500 00

Balance due on and after 15th December, would have been	\$412,764 00
[No. 4.] Interest on which is claimed to 22d December, when final settlement was made.	

*Interest claimed as due on accrued arrears over the \$350,000 security money.*

By Resolve, enacted by the Legislature in 1873, it was ordered that the security money retained from the con- tractors should thenceforward not exceed . . . . .	\$350,000 00
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This enactment was not carried out towards the contractors, and on 1st September, 1874, the amount held back from them, had they been allowed to finish their contract, would have been . . . . .	548,164 00
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[No. 5.] Exceeding the enacted limitation by . . . . .	\$198,164 00
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This large amount had been accumulating from early in July, 1873 (after the Resolve referred to had become law), growing month by month, through means of "short" estimates, and it would be a matter of impossibility to arrive at an accurate calculation of the true amount of interest it should bear. The contractors hold, however, that they can justly claim interest for the average period during which the arrears due them took to accumulate to the above-mentioned sum. In other words,



one-half the time from *15th July, 1873, to 15th September, 1874—seven months.*

*Calculation of Interest on foregoing Items.*

No. 1.	On \$548,164, for 1 month, at 8 per cent.,	.	.	.	\$3,654 00
2.	On 514,264, for 1 month, at 8 per cent.,	.	.	.	3,428 00
3.	On 433,264, for 1 month, at 8 per cent.,	.	.	.	2,888 00
4.	On 412,764, for 7 days, at 8 per cent.,	.	.	.	633 00
5.	On 198,164, for 7 months, at 8 per cent.,	.	.	.	9,247 00
					<hr/>
					\$19,850 00

W. & F. SHANLY.

MARCH 2, 1875.

The whole of the west-end work, to September last, had to be done through the west shaft. When we came to the finishing of the work, a large amount was near the west shaft. The west shaft could only be closed when we could get out at the west end. The work was detained there since February, by destruction of Haupt Tunnel. We could not blast out the rock near the west shaft while the west shaft was in operation; it would have destroyed our machinery.

There was a mere trifle remaining to be done, besides that near the west shaft at the east end, \$759. In central section, about \$3,400, for cleaning up and taking up our track; just what is called finishing work. In the west-end section, \$29,700. These are the amounts which it actually cost to do it. These items are from the pay-rolls for labor. The other items, to make up the \$50,000, are for materials. The wages are the gauge of the time required to do the work.

About \$21,000 of that item of wages was actually dependent on getting out at the west portal. We would have abandoned the west shaft in April but for the destruction of the Haupt Tunnel. The west shaft was 2,470 feet from portal; and the work there was necessarily the last part of the Tunnel.

The Haupt Tunnel was ours. We were bound to keep it open till the last minute. Nobody had a right to destroy that Tunnel.

We got to the bottom of the central shaft in September [August], 1870. At that time there was no appearance of water, and no ground of apprehension on the score of water.

It was the same rock as in the east-end division, and was called mica-schist.

The first large flow of water was in March, 1871. The whole water previously had been about 23 gallons per minute, and it increased to about 80 gallons about 180 feet west of central shaft. That was the first indication giving apprehension of water,—a marked change.

He then read a written statement, as follows:—

#### CENTRAL SHAFT.

##### *Memoranda as to Water Difficulties.*

March, 1871.—The first indications of “wet rock” were observed in March, 1871, and early in that month the “flow” increased so (to some 80 gallons per minute from 23, which it had previously been) that work in the Tunnel, on both sides of shaft, had to be suspended until large pumping apparatus could be prepared.

November, 1871.—The pumping machinery was completed in October, and work resumed in *east* heading; but the threatenings of more water were so apparent in the *westward face*, that the contractors deemed it imprudent to break further into the rock on that side.

On November 17, the contractors, on applying for payment of their estimate, were informed by the chairman of the tunnel committee of the council, that the estimate then due, and those to become due, would be stopped, unless they at once proceeded to “drive” westward from the shaft.

Having an immense capital then invested in the work, the contractors were not in position to combat the imperative orders thus received to “go ahead west;” water or no water, and they accordingly, contrary to the dictates of their own judgment, again broke in westward, and continued work with constantly increasing accession of water, until some time in February, when the water having increased to upwards of 100 gallons per minute, and the rock continuing to show signs of being hopelessly “wet,” they again suspended work in that direction, in the expectation that the evident risk that would be run (of filling the shaft with water) would induce the engineers to view the matter as they, the contractors, did; namely, as contending with what threatened to be an impossibility. In this they were disappointed, and on the 2d of March they received written notice from Mr. Frost, that an order in council had been passed, to the effect that no excuse would be accepted from the contractors for any further delay in going west. On the 14th of March they had an interview with the governor and council, in the expectation that on a representation of all the facts, they would not be compelled to incur the great risk of seeking to penetrate the wet rock any further, until a junction of headings eastward could be effected, and an outlet for the water so gained. In this, too, the con-

1872.

March.

tracters were disappointed, and left the council chamber with imperative orders to "go on." They did so until about the 22d of **May.**

May, by which time the water had increased to *upwards of 200 gallons per minute*, entirely overpowering the pumps, and compelling the contractors to apply the machinery erected for the hoisting of rock to the bailing of water, and also obliging them to put in another pump.

The west-heading work was again suspended, in consequence of the great accession of water referred to as occurring early in May, 1872, and though an order in council was passed in June, again insisting on the westward advance being pressed, the contractors having represented the imminent danger of filling the shaft, and so probably forever deferring the completion of the Tunnel, were tacitly permitted to continue the suspension, and no further advance was made westward until after the 12th of December, 1872, when an opening was made through to the east end.

*Expenditure in excess of Estimates, March, 1871, to May, 1873.*

[1871—March to November.] Whole outlay after water was first struck,—

Wages for labor, etc., . . . . .	\$56,325 03
Castings, etc., for large pump, . . . . .	8,285 79
Teaming from North Adams, . . . . .	3,381 73
Granite for foundations, . . . . .	326 05
Freight on materials, etc., . . . . .	1,200 00

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\$69,518 60

Received for work done, per estimates, . . . . . 14,583 25

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Excess of expenditure over receipts, . . . . . \$55,935 35

This deficit represents the cost of erecting the large pump and machinery in connection therewith, and is a legitimate expenditure,—one of the risks the contractors assumed.

[1871—2—December to February.] Whole outlay,—

Wages for labor, etc., . . . . .	\$57,028 47
Teaming, etc., . . . . .	1,012 17

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\$58,040 64

Estimates of work done, . . . . . 34,478 99

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[Loss No. 1.] Excess of expenditure over receipts, . . . \$23,561 65

This loss is due to threat made on 17th November, 1871, of stoppage of estimates unless the west heading, suspended in March, was at once resumed.



[1872—March to December.] Whole outlay at shaft,—

Wages, etc., . . . . .	\$211,113 99
Teaming, etc., . . . . .	2,863 37
Castings for second pump, etc., . . . . .	4,010 35

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\$217,997 71

Estimates amounted to . . . . .	58,976 75
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[Loss No. 2], . . . . . \$159,020 96

This loss is due to the order in council, notified to us by Mr. Frost's letter of 4th March, insisting on immediate resumption of work in west heading, water or no water. The immense quantity of water "struck" in January and February had warned us that to proceed further westward would be to risk filling the shaft.

[1872-3—December to June.] Besides the losses above enumerated as accruing before the headings east of shaft joined (12th December, 1872), and so relieved us of pumping to surface, we encountered other losses subsequently. When the great flow of water was struck in May, causing final suspension of work westward, the hoisting machinery had to be employed most of the time in lifting water, in aid of the pumps; and the rock from the east heading, the only part of the work we could prosecute after that time, had to be dumped in the Tunnel, so that it finally had to be handled over a second time.

In the period above referred to (12th May to 12th December), the quantity of rock thus accumulated in the Tunnel amounted, according to the engineer's own estimate, to . . . . . 4,122 cub. yds.

The cost of handling it over, and removing it, to . . . \$2.25 per yd.

[Loss No. 3.] Making an actual loss to contractors of \$9,274.50.

*Pumping after Headings joined, 12th December, 1872.*

[1873.] In order to get rid of the water, we had to put in a very large pump at bottom of shaft, so as to send it over the bench, as exhibited on drawing herewith. The bench was then 13 feet high and 1,351 feet long.

This pumping was continuous, night and day, from 12th December, 1872, to 16th June, 1873—168 days; and the outlay per day was \$61.75.

168 days at \$61.75, . . . . . \$10,374 00

Could we have carried on the bench-work consecutively with the heading (eastwards), from May to December, 1872, keeping it 500 feet behind the heading, there would, on December 12, have been but 500 feet of bench remaining to come out, instead of—because of our being hindered in the use of the hoisting machinery for its proper purposes—1,351 feet.

The 500 feet would have taken two months to cut out; the 1,351 feet occupied  $5\frac{1}{2}$  months. Therefore,  $3\frac{1}{2}$  months of pumping charges, or  $\frac{7}{11}$ ths of the whole, were due to the delays forced upon us by the action of the executive in March, 1872.

[Loss No. 4.]  $\frac{7}{11}$ ths of \$10,374 makes . . . . . \$6,601 00

Besides the foregoing direct losses consequent on defying the water in west heading, indirect loss was suffered through their (the contractors) being obliged to suspend work on the "bench," east of the shaft, from May 12th, 1872, to January, 1873.

When headings met, 12th December, 1872, the length of bench in was . . . . .	1,351 feet.
Could the bench-work have been carried on consecutively with the heading, there would have been, on 12th December, only . . . . .	500 feet
left to come out. In other words, there would have been taken out between the above dates, which, at $8\frac{1}{2}$ cubic yards to the foot, would have made . . . . .	7,320 yards,
amounting, at contract rate of \$14 per yard, to . . . .	\$101,220 00
The cost per yard of taking out the bench proved to be \$7.40, making whole cost . . . . .	53,502 00
Leaving a profit of. . . . .	\$47,718 00

which might have been earned in the five months between 15th January and 15th June, 1873, and interest on which, for an average period of about 14 months, ought in justice to be allowed to the contractors, the extreme period to which such interest is claimed being 15th September, 1874.

[Loss No. 5.] Interest on \$47,718, at 8 per cent., for 14 months, \$4,453.38.

There was yet another description of loss inflicted on the contractors by the innumerable delays, inconveniences and hourly, yet nameless, obstructions and expenses incurred through the twelve months' unnecessary fight with the water, forced upon them by the imperative orders of 17th November, 1871, and 2d March following, to drive the west heading at all hazards.

The only work they were enabled to carry on at central shaft, after 12th May, 1872, till the junction of headings, on 12th December, was the eastward heading; and

The whole advance made in that time was . . . . .	849 feet.
The labor pay-rolls for which amounted to . . . . .	\$46,329
Average cost for labor, per foot of heading, . . . . .	\$54
During the same period, in the heading advancing from the west end of tunnel, the progress made, in a rock incomparably harder than that in the heading east of central shaft, was . . . . .	1,072 feet.
At a labor cost of . . . . .	\$40,114 00
Or an average cost per foot advanced of . . . . .	\$37 40

From which it is seen that not far from 50 per cent. was added to the cost of work done in east heading, central shaft, from the nameless, perplexing and incessant difficulties attendant on fighting water.

[Loss No. 6.] This item adds to the contractors' losses, \$14,093.40.

*Summary of foregoing Losses*

No. 1.—December, 1871, to February, 1872, . . . . .	\$23,561 65
No. 2.—March to December, 1872, . . . . .	159,020 56
No. 3.—December, 1872, to June, 1873, . . . . .	9,274 50
No. 4.—Pumping in 1873, . . . . .	6,601 00
No. 5.—Detention of bench-work, 1872, . . . . .	4,453 38
No. 6.—Delays to heading, 1872, . . . . .	14,093 40

Total losses by water, December, 1871, to December, 1872, \$217,004 49

W. & F. SHANLY.

MARCH 2, 1875.

MARCH 10.

TESTIMONY OF WALTER SHANLY—*Continued.*

Q. (By Mr. ALLEN.) At the time when the hearing was postponed the other day, you were about to explain to the Committee the size of the Tunnel that you had made, and to illustrate by showing the sections?

A. I produced some diagrams of the Tunnel just as it was taken out originally. These diagrams show the work that was done eastwards from the central shaft, and these others are diagrams of the work westward; that is, portions of the work. These are not all, but they are fair specimens of the way the Tunnel was taken out.

Q. Does that diagram show the size the whole length of the Tunnel?

A. Oh, no, not the whole length; it would take an immense distance to show that. These sections were taken at every twenty-five feet in the Tunnel,—at distances of twenty-five feet apart. I think these are fair specimens, east and west, of the way the Tunnel was taken out both sides of the central shaft.

Q. Is this roll the same that was shown here the other day?

A. I opened one roll the other day. I think this one eastwards of the shaft is the one I opened.

Q. (By the Committee.) It commences at that end; at the central shaft?

A. Yes, sir, just at the central shaft, and runs half a mile, or thereabouts, I think. It is just a fair specimen of the whole Tunnel as it was taken out.

Q. (By Mr. ALLEN.) These are specimen-sections, as I understand you, to show the size at which the Tunnel is actually taken out?



A. Yes, sir; these cross-sections show exactly how the Tunnel has been taken out.

Q. It is the actual size, as compared with the size of the Tunnel which is prescribed in your contract, where arching is not expected to be done?

A. Yes, it is the actual size, as compared with the *contract-section* of Tunnel, in solid rock.

Q. And wherever arching is to be done over that portion of the work where you have made it larger, it is so much work done towards preparing the way for that?

A. It is.

Q. Now, I would like to ask you to state to the Committee, how you stand pecuniarily on this whole contract; what your disbursements have been, and how they stand in comparison with your receipts?

A. Our disbursements, as compared with our receipts, stand us in a loss of about \$225,000, as nearly as we can make it up now; because we estimate our machinery on hand at a certain sum, which it may or may not fetch.

Q. Have you got any statement made up?

A. I have. [Exhibiting a paper.]

Q. Didn't you prepare another statement or paper, showing the amounts received and the aggregate results?

A. Yes, sir. [Paper produced.]

Q. Won't you explain that to the Committee?

A. I have a statement here, showing the balance-sheet of our books, which shows a loss to us of \$276,495.62; and against that we have our machinery, a very large quantity of machinery, which it is pretty hard to value at this time; but calling it \$50,000 (we used to call it something more than that), it leaves us losers, supposing that we realize \$50,000 from our machinery, to the amount of \$226,495.62. That is made up to the first of January.

Q. Is that valuation of your machinery a just one?

A. Well, it is very hard to say, I am sure, whether it is or not; we couldn't get half that for it to-day, if we were forced to sell. It is worth more than that, a great deal. If we were to judge of it by its original cost, it is worth three times that; but we should be very glad to sell it for fifty thousand dollars.

Q. You would be glad to sell it for fifty thousand dollars to-day?

A. Yes, sir, we should think ourselves very fortunate to get fifty thousand dollars for it.

Q. (By the Committee.) Do you say it is worth more than fifty thousand dollars?

A. I say it really cost a great deal more than that.

Q. What is it worth to you now?

A. I say we should be very glad indeed to get \$50,000 for it. This is a particularly bad time to have property of that kind on hand; a very bad time.

Q. (By Mr. ALLEN.) That statement includes everything in the way of receipts and expenses, does it?

A. It does; everything. It includes all we ever got and everything we ever paid out.

Q. (By the Committee.) Does it include anything for your services?

A. Yes, sir; we always credited ourselves, as managers of the work, with a certain amount every year, of course.

Q. (By Mr. ALLEN.) How much?

A. \$5,000 each.

Q. That is put in as an expense?

A. Yes, sir; included in the general expenditures.

Q. Is there any explanation in relation to that account which you want to give?

A. No; the account explains itself. The items are very few.

*Hoosac Tunnel Contract with F. Shanly & Co.*

DR.—EXPENSES.

To total expenditure, . . . . .	\$4,944,490 51
allowed State for track not laid, . . . . .	36,547 54
interest on advances, . . . . .	31,620 40
	<hr/>
	\$5,012,658 45
Less credit side, or receipts, . . . . .	4,736,162 83
	<hr/>
Balance, . . . . .	\$276,495 62

CR.—RECEIPTS.

By total amount of contract, . . . . .	\$4,594,268 00
interest on certificates paid by State, . . . . .	33,084 52
cash paid by State on account of storm of 1869, . . . . .	3,305 19
sundry extra work done for State, . . . . .	27,115 00
stores, etc., etc., . . . . .	29,183 25
sundry articles sold, labor furnished, etc., . . . . .	49,206 40
	<hr/>
	\$4,736,162 83

Q. That represents actual receipts and actual disbursements, as I understand it?

A. Actual receipts and actual disbursements of every kind. The Committee may like to see the way in which we have made up our expenses. This sheet contains all our expenditures on the Tunnel, with the exception of some few bills which had not been

brought in. [Witness exhibited a large sheet, showing the elaborate and perfect manner in which the expenditures were kept from month to month.] This was made up before the books were quite closed.

Q. (By the Committee.) Did you pay anything for interest?

A. Yes, sir; that has gone in. Every column is headed with what it represents there. That statement shows how much we paid for candles, how much for powder, and how much for everything. It has been made out and kept with the greatest possible care.

Q. When was that made out?

A. O, it was always made out, from the time we started, and brought up every month. It would take months and months to make it out from the start now. We commenced making that statement at the start, and have kept it up. We started with it the very first day, I may say, that we started the Tunnel, and have kept it going month by month, and everything in the way of material and labor that went into the Hoosac Tunnel went into that sheet. I am wrong in saying everything; there were some things which had not been brought in, which, however, are in that balance-sheet; but it contains practically everything.

Q. (By Mr. ALLEN.) Is there any further explanation about that which you want to make?

A. No, it explains itself.

Q. That is a matter not made up at all for this hearing, but it is a statement which has been kept along from the beginning, as I understand?

A. From the very beginning, month by month.

Q. Now, will you proceed to the matter of the quantity of rock excavated?

A. The last day I had the honor of being before this Committee, I found it incumbent upon me to make a correction in one of the items of the schedule attached to our petition; it is item No. 7, "for errors in original measurements of Tunnel rock." I think I stated that I had put down some \$10,000 too much. The ground I went upon was a diagram of the Tunnel recently furnished me by Mr. Frost. By the original sections of the Tunnel, or diagram, the area of the Tunnel was assumed, when we took this work, at a certain figure. Mr. Laurie, who was consulting engineer for two years after we begun the work, stated to us that the area on which our contract had been based originally, was incorrect, and that while working upon it, we would be entitled to considerably more measure, and we made up our item in our schedule according to what Mr. Laurie told us. But when the question came up, the first day this honorable Committee met, I then asked Mr. Frost to



furnish me with a diagram of the Tunnel, which I had never had,—a perfect mathematical diagram of the Tunnel,—and on calculating it, I found that Mr. Laurie's statement was not correct, and that by taking the true aggregate area, according to the statement furnished to me by Mr. Frost, we would be obliged to reduce that item in our petition by \$10,000. Mr. Frost was present that day when I made that statement to the Committee, and he asked me to give him the diagram on which I made my calculations, and which he had himself given me previously, and he has since very fairly and properly sent me a statement that that diagram was not strictly correct, and has sent with it a letter explaining where the alterations were, and that, in fact, the original statement made by us is the true statement; that is, the statement which we made upon Mr. Laurie's statement to us. The original item, as it stood in our petition, is substantially correct. I merely wish to say, that I made the statement reducing our estimates because I was led to suppose that the diagram, as placed in my hands, was correct; but it proves now, as Mr. Frost informs us by letter, that that diagram was not correct, and that our claim for that item, if allowed at all, should be allowed as it originally stands. Item No. 7, *as printed*, is correct.

Q. (By Mr. TRAIN.) There was no change in the original diagram, was there? That was correct, only you misunderstood it?

A. The figures on it were not as they are on this. I have not got the figures with me, but this is a statement from the original. Mr. Frost will put it all right, as to whether the first diagram I refer to was correct or not.

Q. Mr. Frost noticed your mistake, and took pains to set you right?

A. He certainly did. We should not have known anything about it without Mr. Frost explaining it; we should not have known of this re-correction but for Mr. Frost.

Q. (By the Committee.) Do you say that the original diagram furnished by Mr. Frost was incorrect?

A. It differed from this; it was not correct, if this is a true copy, which I hold it to be.

Q. (By Mr. TRAIN.) There was no intention to mislead anybody?

A. Not at all; none whatever; because, if there had been, we never should have known anything about it.

#### CROSS-EXAMINATION.

Q. (By Mr. TRAIN.) How much interest does your statement contain, paid by you in executing the provisions of this contract?

A. It contains about \$280,000,—\$282,000, as nearly as may be. Our interest claim here says \$292,000, but it includes insurance. We keep our interest and our insurance in one account, not to multiply accounts.

Q. Then you deduct a couple of thousand dollars for insurance?

A. Ten thousand dollars.

Q. Does that include \$31,000 interest paid on advances?

A. It does not. That was not paid in cash by us; that was paid as a deduction from the contract.

Q. That was properly charged, under the contract, to you?

A. Yes, sir; there was a clause in the Resolves of 1873, chapter 48, providing for it.

Q. When was your attention first called, in 1868, to the proposition for the construction of this Tunnel under the statute of 1868?

A. I think probably some time in August. Our attention was first called to it by Mr. Latrobe, who wrote to my brother, who was a friend of his, on the subject, and sent him the advertisement. I think it was some time in August; possibly in July.

Q. You had those proposals here the other day, hadn't you?

A. Yes, sir.

Q. Are they here now?

A. Mr. Allen has got a copy.

Q. It is calling for proposals under what you call an item contract?

A. Yes [exhibiting a paper]; this is a copy of the tender or proposition sent into the commissioners on the Hoosac Tunnel at the time.

Q. The advertisement calls for bids upon the various items contained in these specifications?

A. Yes, sir.

Q. And what action did you take upon the receipt of those specifications?

A. Well, we did as other contractors did who bid on the work; we went and examined the work, went into the Tunnel, and made a careful examination of everything.

Q. What engineers did you confer with?

A. Mr. Frost himself, and Mr. Ellis, were there at the time.

Q. And Mr. Latrobe?

A. No; I didn't see Mr. Latrobe until after our tender was in, when I met him in the state house here.

Q. When was the tender made under that specification?

A. I think it was about the last week in August, 1868; it might have been the first week of September, but it was somewhere there-

abouts. It was some four months before the contract was made, at all events.

Q. Four months before the final contract was made?

A. Yes, sir.

Q. Before any contract was made under these proposals, did you withdraw from competition for the contract?

A. No, I don't remember any withdrawal.

Q. I want to call your attention to a letter, a copy of which I have [exhibiting to witness a letter signed "F. & W. Shanly," dated October 16, 1868, addressed to Oliver Warner, Secretary of State]. That is what I mean by withdrawing?

A. O yes; we didn't want to stand in the way. I remember that perfectly well.

Q. That letter you sent same time?

A. Yes, sir.

Mr. Train read the letter, as follows:—

NEW YORK HOTEL, NEW YORK, 16th October, 1868.

DEAR SIR:—We have the honor to state, for the information of the governor and council, that we have not yet been able to close such financial arrangements as would enable us to comply with the condition of depositing half a million dollars in bonds or stocks as security for the completion of the Hoosac Tunnel contract, and as the time allowed us expires to-morrow, we therefore stand aside for others.

Should it happen that no contract be concluded with other parties, having tendered for the work, we will be prepared, and glad, to carry out our propositions of 26th August, or to enter into contract on such modification of the terms of that offer as might be agreed upon, should the governor and council deem fit to re-open negotiations with our firm.

Shortness of time wherein to perfect them, has alone interfered to prevent our making satisfactory arrangements now.

With a high sense of the courtesy shown us by the governor and council,

We remain, your obedient servants,

F. & W. SHANLY.

OLIVER WARNER, *Secretary Commonwealth of Massachusetts.*

P. S.—Our address, as heretofore,—

FRANCIS SHANLY, Toronto, Canada.

WALTER SHANLY, Montreal, Canada.

Q. After the transmission of that letter, you did nothing until what time?

A. I suppose it was probably some time in November, when we got another call from the secretary of state, asking us to meet the governor and council upon a new basis. It was some time in



November, and I think probably late in November. I would like to state that the original basis, when we were first sent for by the governor and council, was that the contractors (not ourselves only, but any other parties to whom the contract might be awarded), should deposit half a million of dollars in the hands of the state treasurer, as security on the contract. That proposition was made to us as to others. My brother and myself came here, saw the governor and the honorable council, and asked them to give us some little time to consider this proposition. They gave us some little time, but we were not able to do that, and we wrote them a letter, just now read, saying we couldn't do it. We supposed that was the end of it, and thought nothing more about it until one of the commissioners came to Canada to see us (the Hon. Tappan Wentworth), to say that there was another proposition up, and asking us to have another interview with the governor and council. We came on accordingly. At that interview, a proposition was submitted on the basis of the present contract, which was not the basis of a deposit of \$500,000; but we agreed to spend \$500,000 on the Tunnel before we got anything from the State. The first proposition we didn't accept, and therefore they sent us a proposition on a different basis, which we accepted.

Q. When your attention was called to the contract, in November, were you not told that the contract was to be an entire contract, and not an item contract?

A. I think that was when we came to make the contract. Of course I am speaking of dates from memory. This interview I speak of, I think, was in November.

Q. You mean the interview with Mr. Wentworth?

A. Yes, sir. That was in November, and we made this proposition, and then there was some time taken to consider; and towards the latter part of December we were sent for again, when the governor and council told us that our offer was accepted, and then we went into the details of making the contract. Mr. Latrobe was there as consulting engineer. We had our own lawyer there, Mr. E. H. Derby, at that time, and then it was that it was proposed that instead of having what is called an "item contract" we should put the whole thing into a bulk sum, which we agreed to on the assumption, or under the assurance, that the engineer's estimates of quantities were sufficiently accurate. That was in December; the contract was signed on the 24th December, 1868.

Q. If I recollect right, you were some two or three weeks in making this contract?

A. I think we must have been all of two weeks. There were several drafts of the contract made.

Q. You met the Committee in the council chamber with your counsel?

A. Yes, sir.

Q. And went on from day to day?

A. We didn't actually go on from day to day, Mr. Train; there were other matters intervened. For instance, there were certain parties came in and objected in various ways, and they took a great deal of time. I remember General Butler was in on some person's behalf,—Mr. Odiorne's, I believe it was,—and there was a great deal of time lost. Our business didn't take the two weeks, though we were in attendance all the time.

Q. But during that time, you were preparing the contract to do this work for a gross sum, not according to the original proposition which had been made in August?

A. Yes, sir.

Q. So that there was no misunderstanding or misapprehension?

A. No; the contract speaks for itself. It is for a gross sum; it is not an item contract at all, it is a gross-sum contract.

Q. You were familiar with the statute of 1868, under which that contract was made, weren't you?

A. Well, I was at the time, of course.

Q. You informed yourself of the condition of the mountain by consulting the engineers of the State?

A. Yes; we saw the engineers when we visited the Tunnel in August.

Q. And by a personal examination?

A. Yes, sir.

Q. And the engineers included Mr. Latrobe and Mr. Laurie?

A. No; Mr. Latrobe was not at the Tunnel at that time.

Q. But you saw him before you made your contract?

A. Yes, sir; but not before we made the tender. Mr. Frost and Mr. Ellis were the engineers we saw before we made the tender.

Q. Did Mr. Latrobe advise you as to the character of the work?

A. Not at all; he simply wrote to my brother,—they were old acquaintances,—and drew his attention to the fact that preparations had been made, and saying that the work was one worth looking at.

Q. Had you read and understood the different geological reports that have been put in by Mr. Allen, which had been made before that time?

A. Not all of them; a good many of those reports have been hunted up since. I had a general idea of the geology of the mountain, but I don't remember what books I got it from. In fact, I had known the Hoosac Tunnel a good many years; kept the run of it just as an engineer would of an interesting work.

Q. You are an engineer yourself?

A. I am.

Q. And your brother also?

A. Yes, sir.

Q. Then the documents which you have referred to here as indicating the character of the rock and the probability of finding water or otherwise, you were not familiar with at the time you made the contract?

A. Not with all those reports. There were a good many reports which I had not seen.

Q. You have referred to President Hitchcock's report?

A. Yes, I knew about President Hitchcock's report on the mountain, but I had not seen all the reports. I had a general idea of the geology of the mountain, formed from time to time, over a series of years, and of the progress of the work on the Tunnel—the general features of it.

Q. Then your propositions were based first upon your own knowledge, derived from a personal examination of the Tunnel, the mountain and the work, from Mr. Frost, and from Mr. Laurie?

A. No, not from Mr. Laurie; he was not there.

Q. What other man, besides Mr. Frost, was there?

A. Mr. Ellis, who was the assistant engineer.

Q. And from some knowledge of Dr. Hitchcock's report?

A. Yes, sir. The general geological structure of the mountain had been pretty well known to me.

Q. And your own experience as an engineer?

A. Yes, sir.

Q. How extensive was that experience? In 1868, how many years had you been engaged on this kind of work?

A. I had not been engaged on any works of this kind; there were none like it.

Q. I mean, works peculiar to your profession as an engineer?

A. For more than twenty-five years.

Q. As contractor or engineer?

A. Engineer.

Q. Had you contracted to any extent yourself?

A. No, I had not; my brother had.

Q. To what extent had your brother contracted?

A. Very considerably.

Q. In what sort of work?

A. Railroad work.

Q. Is he your senior?

A. He is my junior by three years.



Q. How soon after the execution of the contract did you enter upon the work?

A. The contract was executed on the 24th day of December, 1868, and we actually commenced drilling rock on the 29th day of March following. Of course, we had practically commenced the work before that, because there was a great deal to do in getting our tracks and machinery ready, but our actual striking into the rock of the Tunnel took place on or about the 29th of March.

Q. Where was that?

A. At the east end.

Q. How soon did you begin at the central shaft?

A. Well we begun work at the central shaft, I think, a little before that. Of course we had to do an immense deal of work there, too, before we struck rock. I can't say exactly, but I rather think our first rock was struck in April. There was an immense amount of work to be done at timbering, etc., before we could do any excavation.

Q. There is one question I should have asked you before: whether you had had any experience in mining?

A. Yes, sir, I had; in copper mining.

Q. Where?

A. In the Eastern Townships, Canada, Province of Quebec.

Q. Extensive experience?

A. Very considerable.

Q. Now I will come back to the central shaft. How soon did you begin to excavate from the shaft?

A. I can't say exactly, but it was some time in April. If I were in my office, I could tell you exactly; but really I can't say now, but it was in April.

Q. My recollection is that the shaft was not down when you took the contract?

A. O no; it was rather more than half way down.

Q. Your first work was to finish it?

A. Complete it to the level of the Tunnel floor.

Q. Right there the contract calls for a sump?

A. Yes.

Q. Was that ever completed?

A. O yes; we couldn't pump the water from the shaft without it.

Q. According to the contract?

A. Yes, sir. There were no dimensions given for it. We had to have a sump; we couldn't get on without it at all.

Q. (By the Committee.) What is that?

A. It is a well. When we get down to the bottom of a shaft

we make a well; it is a miner's term. It is simply a well, which will allow the water to gather.

Q. The provision in the statement here calls for a fifteen-foot sump. What I want to get at is, whether you understood that you were to sink a sump fifteen feet at \$395 a foot?

A. We were to sink it enough for the water; that is all we understood by it.

Q. In this statement, it is prescribed that it shall be fifteen feet; in the other statement, the depth is not prescribed, neither is it in the contract?

A. I never measured the depth myself; it was a matter of no consequence, so long as it was deep enough to receive the pumps and answer the purpose. Of course, it had to be filled up again when the Tunnel was done; it is not a permanent part of the Tunnel, it is merely an auxiliary.

Q. Now, to resume; you commenced on the central shaft in April,—when did you get to the floor of the Tunnel?

A. We got to the floor of the Tunnel at the central shaft, I think, about the end of August, 1870.

Q. Then, did you proceed to work both ways?

A. Yes, sir.

Q. And how long did you continue to make progress in both directions from the central shaft?

A. Well, in the eastern direction, we always continued, except during forced periods of suspension; but we permanently suspended at the west heading in May, 1872.

Q. Then you worked continuously from April, 1869, to May, 1872?

A. No, we didn't. You asked when we began working both ways. We began to work both ways in September or October, 1870, and we suspended work there on account of the great influx of water in March following, and remained suspended until the November following, because of the necessity of putting in very large pumps, which prevented our doing anything else at the shaft.

Q. Those pumps were pumps owned by the Commonwealth, were they not?

A. O no; those pumps we had to get made ourselves.

Q. What machinery was there belonging to the Commonwealth that you had the use of?

A. Well, there was a hoisting-engine, an engine we used for pumping, and there was some machinery in what we called the shop, and a drill or two. There was not much machinery at the central shaft; there were three boilers; there was less at the central shaft than at either end of the Tunnel belonging to the State.

Q. How soon did you say you put in the pumps?

A. It took us from March, 1871, when we first struck water, until, I think, about September following, or thereabouts, to get our large pump into the shaft.

Q. What progress had you made in either direction from the central shaft prior to your putting in the pumps?

A. Well, I cannot give it to you exactly, but I think I can come near it; very little. We had made about 174 feet west and about 130 feet east, I think.

Q. In how many months after you got to work?

A. We got to work there about October, I think, or November; it must have been four or five months.

Q. You got to the bottom of the shaft in August?

A. Some time in August, yes. Then it took some time to get to work. We commenced somewhere about October to "drive," as we call it, either way. Of course, as it is upwards of four years ago nearly, I speak from memory; it was some time in October, I think. We should have commenced by September, but were delayed by a terrible accident, in which we lost our superintendent there; that lost us two or three weeks; we didn't get fairly at it until some time in October.

Q. Then the water interfered with your operations in March?

A. In March following.

Q. At that time, had you excavated 200 feet west?

A. No, sir; I think we had not got 200 feet west; we were about 174 feet west and 134 feet east, or thereabouts.

Q. And your contract called for 80 feet per month?

A. Yes, it did; but that 80 feet, of course, was to count from the time we got our machinery in.

Q. When did you say that was?

A. Well, we required to have some room for that. We had to work by hand to get room for our machinery.

Q. I want to fix the time; the correctness of your statement, I do not question; I only want to know when it was?

A. As I say, we abandoned the work until we got the pump in,—from March, 1871, until some time in the autumn of 1871. We got our machinery in probably about November, 1871.

Q. But when you got to the bottom of the central shaft, you had to make preparations and put in the machinery before you went to excavating?

A. Of course, we couldn't put in our machinery then. We had to work by hand to get room to put in the machinery.

Q. You went to work east and west?

A. Yes, sir, east and west.



Q. And you worked until the following March?

A. Yes, sir.

Q. And then water began to trouble you?

A. Yes, sir.

Q. And then you stopped to put in machinery, by which you mean pumping machinery?

A. Yes, sir; then we stopped to put in pumping machinery.

Q. What machinery do you mean when you speak of hand-drilling to make room for it?

A. Machinery to drive our headings. We drove them by machine-drills; but in order to work machine-drills, we have to make a place to put them in, by means of hand-drilling, which took four or five months; because every time we blast, we must have room for the drill-carriages to be moved back; therefore, we have to make the room first.

Q. Had you arrived at that stage of the work when the water came in?

A. No, we had not; we hadn't got quite room enough for our drill-carriages at that time,—very nearly, but not quite enough.

Q. Then in March you came to a dead stand, and proceeded to put in pumps?

A. We did.

Q. When did you get your pumps completed, so that you cleared the Tunnel of water?

A. I don't think they were thoroughly completed until some time in October following, 1871.

Q. Then did those pumps keep the work free?

A. They kept the work free until we reached a point probably one hundred feet further west; then they didn't.

Q. When was that?

A. We reached the point where we were finally overpowered by water very early in May, 1872.

Q. Now, do you mean to say, that if you had put in additional pumps, you could not have exhausted that water, so as to have proceeded with your work?

A. O! I think very likely pumps might have been put in to pump twice that amount of water. I am quite sure they could,—quite sure.

Q. All it wanted was the outlay?

A. The outlay, yes.

Q. But those you never supplied?

A. O yes; we put in additional pumps afterwards.

Q. Yes, but you never put in pumps sufficient to keep the water down?

A. No, we never had pumps enough to keep the water down. In May, 1872, we had to use our hoisting machinery, which should have been hoisting rock, to bail water, to supplement the pumps.

Q. Instead of using pumps, you bailed the water out?

A. Yes, sir.

Q. You had steam-power enough, and that was furnished by the Commonwealth?

A. No, nothing like it; scant enough for what we had to do.

Q. When you say you had nothing like power enough, do you include bailing-power, or simply pumping-power?

A. Pumping-power; I am speaking of pumping-power. Of course, the bailing is an illegitimate way of doing the work; it was only because of necessity that we had resort to it.

Q. I understand you to say, there was steam-power enough to work the pumps that you actually put in?

A. Yes, sir.

Q. But not enough to work any more?

A. No, not enough to work any more pumps.

Q. The result of it was that you never made the monthly progress from the central shaft which the contract called for?

A. O yes; more than double; two and a half times. The contract required us, in the west heading, for instance, to go 80 feet a month, and we went 184 feet a month when we got at it. O yes, a great deal more; on an average, more than double.

Q. Let me call your attention to this clause in the contract:—"They shall employ suitable force, and shall maintain, after June 1, 1870, an average rate of monthly progress of Tunnel excavated to full size, east and west" [that is, from the central shaft] "of not less than 80 feet in each direction." Now, after June, 1870, did you comply with that provision of this contract?

A. No; I told you just now that we suspended from March, 1871.

Q. Then the result was you never complied with that provision of the contract?

A. Certainly.

Q. What did you mean by saying that you did twice as much?

A. Yes, we did; when we got at it.

Q. You didn't do it in that way?

A. No, we didn't work in that way. There are a great many things in that specification which we didn't do; we worked it our own way, and well was it for the Tunnel that we did.

Q. You never made an average of 80 feet a month?

A. I really forget whether we did or not; I know we went as much as 184 feet one month, where the contract called for 80; I

also know that the Tunnel was completed by the first of September, 1874; I don't know about the monthly average; I know the engineers always said, "You must do 80 feet each way every month"; if we did 160 feet one month and didn't do anything the next month they held that that was not complying with the contract. We could never see that; we thought if we did nothing this month and did twice or three times as much as the contract called for the next month, that it was just as good; we always held that. The engineers always said, "No; you must do the prescribed rate in each place each month."

Q. Did you ever come within a thousand feet of the average?

A. I can't say that; but, looking at the Tunnel, I know we came up to the average entirely, because the Tunnel was done within the contract time. With regard to the averages, I suppose at the east end our monthly progress averaged about  $33\frac{1}{3}$  per cent. above the contract rate. In the west heading, central shaft, it averaged considerably more than that right along, when we were not stopped by water. We held that if we had done 180 feet at one end it was as good as doing 100 feet at one end and 80 at the other; the practical result to the Tunnel was the same, provided we got it done within the time.

Q. The amount of it is this, the authorities required you to make progress according to the terms of the contract?

A. They did.

Q. And you declined to do so?

A. We did not decline to do so, but we couldn't do so.

Q. You might have done so, if you had put in sufficient pumps?

A. In one way, we did decline; for instance, the contract required us to do 100 feet a month at the west end, and we did 150.

Mr. TRAIN. I don't want you to evade my inquiry.

WITNESS. No; but it must work both ways.

Mr. TRAIN. You shall have all the opportunity to explain you want.

WITNESS. We didn't make the 80 feet, for we didn't make any progress at all.

Q. (By Mr. TRAIN.) You might have done it with suitable pumps?

A. No, we could not.

Q. Didn't you tell me just now that you could have put in pumps that would have taken out twice the amount of water you did?

A. Then we would have lost more time; we lost nine or ten months in putting in one pump, and if we had lost nine or ten months in putting in another, the result would have been that the completion of the Tunnel would have been delayed.



Q. Then you think it would have occasioned more delay to have put in sufficient pumping-power than to have done the work as you did do it?

A. I am perfectly certain of that; just as certain as that I stand here..

Q. (By the Committee.) There is one thing I do not understand. Was the steam-power furnished by the State?

A. Yes, sir; the State had steam-engines there, and they allowed us to use such machinery as they had there, as the contract shows.

Q. They allowed you to use the machinery; they didn't furnish any power?

A. O no; the machinery was there, and we were allowed the use of it.

Q. Would it have required more steam-engines to have run additional pumps?

A. O yes; there is no calculating what the water might have been; it might have taken a great many more pumps.

Q. (By Mr. TRAIN.) Your contract required you to furnish all the power necessary for pumping, machinery and everything else?

A. Yes, sir.

Q. So that you could make 80 feet progress each way every month?

A. Yes, sir.

Q. That you never furnished under the contract?

A. Yes, we did.

Q. Did you say you did furnish it?

A. O yes; pumps were furnished.

Q. You never furnished pumps enough to keep the central shaft free, so that you could comply with the contract, and make your monthly rate of progress?

A. We didn't, because we wanted to finish the Tunnel within a certain time.

Q. Now, when was the storm for which you have claimed damages?

A. It was on the fourth day of October, 1869; the *great* storm was.

Q. After that storm, you made a claim on the Commonwealth for damages?

A. We did; not for damages—no.

Q. Well, for something or other?

A. Some work done.

Q. Didn't you make a claim upon the Commonwealth for damages?

A. I don't think so; I have no recollection of that; we furnished them a bill of work done in connection with that storm, that we thought they ought to pay us. I don't think we ever claimed any damages of that kind.

Q. Well, will you have the kindness to state what damage that storm did to the west side?

A. Here is a diagram of the west end and west portal of the Tunnel. This is the west shaft, from which all the western section of the Tunnel was worked. This piece here was what was called very bad rock, from the first, and this had to be arched all the way through. All the rock that was got out there for three years was taken out through here (the shaft). Then we had to build this façade. Here was what was called the Haupt Tunnel. It went through this hill; that was not in our contract; it was in the Farren contract; but we ran all our material out here. Mr. Train has just asked me what harm the storm of October, 1869, did. It broke the embankment of the water-course that ran alongside the Tunnel on the side of the hill above, and brought down such an immense amount of drift and debris as to fill up the Tunnel entirely. It filled up the main tunnel 800 or 900 feet; filled the Haupt Tunnel, also, and stopped our work at the west shaft. The water set back along up here somewhere. It was completely filled up to the very top of the Tunnel here with water. It was dammed up for nearly 900 feet with rock and rubbish,—the most complete filling up of a Tunnel you can imagine,—and therefore the water was dammed in until we cleared the rubbish away and made an exit for it here.

Q. You sent a communication to the governor and council on the 19th November, 1869, didn't you?

A. Yes, sir.

Q. Have you got that here, Mr. Shanly?

A. Mr. Allen has it, I think.

Q. After the storm of the 4th October, 1869, you repaired all these matters that you have referred to just now as having been injured by the breaking away of the brook?

A. No, we didn't all; we did enough then to enable us to resume work, but there was a certain amount of this debris and rubbish left in the Tunnel still.

Q. In the Haupt Tunnel, you mean?

A. No, we had to clear out the Haupt Tunnel; it was so small that we couldn't spare any room there. We had to clear that out entirely; there was not room enough in that to allow of our leaving anything there; but in the main Tunnel, we left considerable of this stuff until lately, simply because there was no hurry about it.

Q. With that exception, you repaired all that damage, some of

which was allowed by the Commonwealth, and some of which they disallowed?

A. The State did some work there; they had some of their men there. There was considerable work to be done; the road had to be changed; it is a complicated thing to explain, unless on the spot. The State did considerable work there.

Q. On the 19th November, you sent this communication to the governor, which I will read:—

*To His Excellency and the Honorable Council of the Commonwealth of Massachusetts.*

The Hoosac Tunnel Contractors beg leave to inform His Excellency and Council that they have now completed such of the repairs of damage done by the storm of 4th October at west end of the Tunnel as they undertook to do, and that their outlay thereupon has amounted to \$6,485.52.

Certain other work of restoration and repair has been done by Messrs. Hocking & Holbrook (sub-contractors of W. & F. Shanly for the construction of the brick-work), chiefly within the Farren arch, and for which they (Messrs. H. & H.) look to the Commonwealth to reimburse them.

The contractors submit herewith statement of account-current (outside of their contract) standing between themselves and the Commonwealth, and showing balance in their favor of \$3,883.65.

The disbursement of so large a sum of money, not credited to them in the monthly certificates of indebtedness, is a great burden and inconvenience to the contractors in the carrying on of their Tunnel work. They, therefore, respectfully urge that His Excellency and Council will cause them to be reimbursed without delay the amount above stated to be due to them; namely, \$3,883.65.

(Signed,) F. SHANLY & CO.

NORTH ADAMS, 19th November, 1869.

*(Endorsed on back):*

*The Commonwealth of Massachusetts to F. SHANLY & Co.*

1869.

DR.

Sept. 30.	To account sundries as read and accepted, . . .	\$630 36
Oct. 31.	To labor furnished to engineers at East End in October, . . . . .	25 00
Nov. 16.	To outlay in repairing damage done by storm of 4th October to state property West End of Tunnel, .	6,485 52
		<hr/>
		\$7,141 54

CR.

By account sundries rendered by Mr. Bond, . . . . .	3,257 89
	<hr/>
Balance due F. Shanly & Co., . . . . .	\$3,883 15



Q. Is any portion of that included in your present claim for damages?

A. Yes.

Q. What portion of this amount, \$3,883.65?

A. They paid us on account afterwards \$3,500 and a fraction, so that there is the difference between those two sums included in our claim.

Q. With interest on it, I suppose?

A. We have not added any interest to this item in our claim.

Q. Now, this report of the committee of the council was communicated to you?

A. It was; yes, sir.

Mr. TRAIN read as follows:—

#### COMMONWEALTH OF MASSACHUSETTS.

COUNCIL CHAMBER, BOSTON, December 9, 1869.

The Committee upon the Hoosac Tunnel, to whom was referred the communication of Messrs. W. & F. Shanly, contractors, dated November 19, 1869, report as follows:—

As to the first item, dated September 30, for amount of sundries rendered and accepted, and the second item, for labor furnished to engineers, dated October 31, the Committee are informed by the engineer in charge that these items are contained in the account-current kept with the contractors, and are entirely foreign to the principal item in this account. They should be rendered in a separate and distinct account. As to the item dated November 16,—“Outlay repairing damage done by the storm of October 4 to state property, west end of the Tunnel,”—

The Committee are of the opinion that it should show in detail the different parts of the work; viz., the work done in repairing the bank of the brook, and the work done in equalizing the weight of the earth upon the brick arch, with the cost of each, in order that the principles adopted in the orders of the council passed October 15, 1869, and contained in the report of the tunnel committee upon the subject of the damage to the Tunnel by said storm (a copy of which report is hereto attached) may be applied to said account.

The credit item in said account, we are informed by Mr. Frost, is for property sold by the Commonwealth, by its agent, Mr. Welch, to the Messrs. Shanly, and is open to the same objections as the first two items, and should not appear in this account.

As to the clause in the communication of the Messrs. Shanly concerning the work of restoration and repair done by Messrs. Hocking & Holbrook (sub-contractors of W. & F. Shanly), the Committee report that the Commonwealth has made no contract or arrangement with Messrs. Hocking & Holbrook for any repairs or for any work of any kind upon the Tunnel, and that if they have performed any work upon the Tunnel it must be by

reason of a contract with some third person, to whom they should look for compensation.

JOSEPH TUCKER, *Chairman*.

December 9, 1869. Report accepted.

OLIVER WARNER, *Secretary*.

Mr. TRAIN. The propositions referred to in that report, and which were submitted to the Messrs. Shanly, are these,

### HOOSAC TUNNEL.

#### *Propositions.*

1. The contractors took the contract subject to all contingencies, and should have taken them into consideration.

2. The brook on the west end is not one of the appliances requisite for the completion of the Tunnel, and therefore the contractors are not obliged to repair it, unless such repair is necessary in order to enable them to carry on their own work. But if the brook breaks loose and injures or tends to injure the Farren arch, then it is no fault of the contractors, because they have not agreed to keep that brook within bounds, except so far as their own interests are concerned. If the brook injures the contractors only by preventing a continuance of their work, they must repair at their own charge. If it only injures the brick arch or covering of the arch, then the State must repair.

It would seem to follow that whenever the brook so breaks as to injure both parties, both have a joint interest in applying the proper remedy. In applying these principles, if it be found that the *future* security of the brick arch will be hazarded unless the breach in the brook is repaired, and at the same time that the repairs must be made to enable the contractors to prosecute their work, it would seem to be clear that both parties should join in the expense.

Acting upon these views, the Committee have instructed the engineers to proceed immediately to level the material on the top of the brick arch, so as to make a proper equalization of the bearings, at the expense of the State. In doing this the contractors *at their own charge* may remove the material collected in the space between the portal of the brick arch and the mouth of the Haupt Tunnel to and upon the brick arch, so far as they desire to do so; they do such work, and make such removal, in such manner as our engineers may direct. As to what the State will do in bearing a part of the expense of repairing the breach in the brook, and making the same safe, the Committee informed the contractors that they would report to the governor and council, and that the action of the governor and council should be reported immediately to the contractors. The Committee took the ground, in conversation with the contractors, that the State was under no obligation to remove any of the material which has been carried into the mouth of the Tunnel, and extending from thence to and into the mouth of the Haupt Tunnel, or bear any part of the charge of removing the water from the Tunnel.

JOS. TUCKER, *Chairman*.

ATTORNEY-GENERAL'S OFFICE, October 21, 1869.

Having examined the foregoing propositions, I am of opinion that the several matters therein mentioned as to be done on the part of the Commonwealth, are within the authority of the governor and council; and that they have authority, and it is their duty, when the legislature are not in session, to take such measures as may, through unforeseen circumstances, become reasonable and necessary, for protecting and preserving property of the Commonwealth which is not specially put in charge of other persons under the laws.

CHARLES ALLEN.

COMMONWEALTH OF MASSACHUSETTS.

EXECUTIVE DEPARTMENT, BOSTON, October 15, 1869.

*Ordered*, That in consideration of the breaking away of the embankment of the brook on the westerly side of the Hoosac Mountain, by which a portion of the material covering the Farren arch was carried away, and fears are entertained by the state engineers that further damage to the archway be occasioned thereby, the Commonwealth will pay to the contractors for the construction of the Hoosac Tunnel, one-half part of such sum of money as shall be judiciously expended by them in repairing the breach in said brook and making the same safe; said work to be done in such manner as shall be approved by Mr. Laurie and Mr. Frost, state engineers.

Adopted.

*Ordered*, That the engineers of the Hoosac Tunnel be authorized to expend a sum not exceeding one hundred dollars in effecting a drainage of the rear of the "Farren arch," and it is further *ordered* that said engineers be instructed to cause the pressure upon the top of the arch, occasioned by the recent freshet, to be equalized, so as to provide for the security of the arch.

Adopted.

COMMONWEALTH OF MASSACHUSETTS.

SECRETARY'S DEPARTMENT, BOSTON, February 12, 1875.

A true copy.      Attest:

OLIVER WARNER, *Secretary of the Commonwealth.*

WITNESS. The whole amount we ever received, on account of the storm, was \$3,305.19.

Q. You claim the balance?

A. Yes, sir, if I know what you mean. There were certain debits which were allowed to us; those were settled separately; we did, with respect to these, just as the council wanted us to do, and took those accounts out and settled them otherwise.

Q. (By Mr. ALLEN.) This account of Mr. Bond—\$3,257.89—you settled otherwise?



A. Yes, sir; the council did not want to mix the matter up, and we settled it otherwise by direct payment.

Mr. TRAIN. I wish to put in one paper more. I have a copy of the voucher of the Shanlys:—

## VOUCHER 6,491.

*The Commonwealth of Massachusetts, &c., To F. SHANLY & Co.,* DR.  
1869.

For repairing break in Tunnel Brook "West End," for moving material to equalize the pressure upon the arch and for culvert drain as per order of governor and council, October 15, 1869.

Oct. For 1,553 $\frac{3}{4}$  days' work by F. S. & Co., on water-course and road, at \$2.074, . . . . . \$3,222 48 \$1,611 24

159 $\frac{1}{4}$  days' work by H. & Holbrook on  
water-course and road, at \$2.074, 330 28 165 14

---

1,713 \$3,552 76

$\frac{1}{2}$  of the above items allowed.

For 258 days' work by F. S. & Co., covering arch  
and drain, at \$2.074, . . . . . \$535 09

For 7 days' work by H. & Holbrook, covering arch  
and drain, at \$2.074, . . . . . 14 52

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549 61

November. For 549 $\frac{1}{2}$  days' work by F. S. & Co., on  
water-course and road, at \$2.074, . . . . . \$1,139 66

$\frac{1}{2}$  of the above item allowed, . . . . . 569 83

For 110 $\frac{3}{4}$  days' work by F. S. & Co., covering arch and on  
drain, at \$2.074, . . . . . 229 69

October and November. For use of tools and material fur-  
nished by F. S. & Co., \$124.20,  $\frac{1}{2}$  allowed, . . . . . 62 10

For use of tools and material furnished by H. & H., \$176.86,  
 $\frac{1}{2}$  allowed, . . . . . 88 43

For 3,239 feet logs, at \$18 M, furnished by H. & H., \$58.30,  
 $\frac{1}{2}$  allowed, . . . . . 29 15

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\$3,305 19

This voucher includes the following work done and materials furnished by Hocking & Holbrook (sub-contractors to Messrs. F. Shanly & Co.):—

October. 159 $\frac{1}{4}$  days' work on water-course and road, at \$2.074,  
\$330.28,  $\frac{1}{2}$  allowed, . . . . . \$165 14

7 days' work covering arch and on drain at \$2.074, \$14.52, al-  
lowed, . . . . . 14 52

October and November. 3,239 feet logs at \$18 M, \$58.30,  $\frac{1}{2}$  al-  
lowed, . . . . . 29 15

Use of tools and materials furnished, \$176.86,  $\frac{1}{2}$  allowed, . . . . . 88 43

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\$297 24

Audited and copied by AUSTIN BOND.

Jan. 23, 1872. Received of the Commonwealth of Massachusetts, through the Commissioners upon the Troy and Greenfield Railroad and Hoosac Tunnel, thirty-three hundred five dollars and 19 cents as above stated.

(Signed)

F. SHANLY & CO.

I hereby certify that the above bill has been examined and is approved by me.

(Signed)

BENJ'N D. FROST, *Chief Engineer.*

NORTH ADAMS, December 19, 1870.

Copy. Attest:

(Signed)

CHAS. ENDICOTT, *Auditor.*

WARRANT 663, DEC. 20, 1870. ORDER OF COUNCIL.

"*Ordered*, That the sum of thirty-three hundred and five and  $\frac{19}{100}$  dollars (being the amount due F. Shanly & Co., for repairing damage done by flood of October 4, 1869, at the west end of Hoosac Tunnel) be paid Benj'n D. Frost, Engineer, agreeably to his requisition, dated Dec. 13, 1870, and that a warrant be drawn for the same."

Order adopted Dec. 16, 1870.

Q. You have stated this morning that you make a claim to consideration in consequence of the increased size of the Tunnel?

A. I don't think I said we made a claim; we have simply stated in our petition, that under all the circumstances of the case it might be considered; we do not put it in the way of a claim, by any means.

Q. Why did you make the Tunnel larger than the contract calls for?

A. It is usually the case, that a Tunnel is made larger to insure full size.

Q. It is a cheaper way of doing the work, isn't it?

A. It is better than going over the work again, a great deal better.

Q. You mean to answer my question in the affirmative?

A. Yes, sir, I say so.

Q. It is a pretty difficult thing to keep within Tunnel lines, isn't it?

A. You can't keep to accurate lines in rock of that kind; in what is called "refractory rock" you can't keep accurately within Tunnel lines.

Q. The work that is done outside of the Tunnel lines is a risk which contractors always take, isn't it?

A. Yes, sir, it is.

Q. You do not claim that anything should be allowed you for work done outside of the lines?

A. We do not *claim* that, no; our petition states that distinctly. We do not claim it.

Q. It was not within your contract?

A. We do not claim it at all.

Q. Portions of these excavations were not only outside of the Tunnel lines, but they were excavations that would not ordinarily occur; they were made intentionally, outside the Tunnel lines, were they not? I refer to the excavations easterly from the central shaft?

A. Yes, sir, those were intentional to a great extent.

Q. In the course of your examination, you have spoken of a loss of interest by reason of short estimates?

A. Yes.

Q. Will you explain what you mean by "short estimates"?

A. Estimates that did not cover the whole of the amount in money that was coming to us.

Q. Do you mean to say, that any time during the performance of the work, the monthly estimates did not cover all the progress that you had made, according to the terms of the contract?

A. I don't know whether they did or not, because I did not make the measurements, but I mean to say, that the amount held back from us was more than the Resolve of 1873 authorized to be kept back; that is what I mean. I did not make the monthly measurements, and I cannot say as to that.

Q. Do you understand the Resolve of 1873 to change the contract between you and the Commonwealth?

A. O yes, distinctly.

Q. In what way?

A. In the security. According to the original contract there was to be twenty per cent. kept back from each monthly estimate until the amount reached \$1,000,000. We applied for relief from that condition, as the work was getting on to completion, and that Resolve was passed by the legislature, which provided that from that time forward, June, 1873, the total amount kept back should be \$350,000, and no more. That is as I understand the Resolve; I think that is the way it reads.

Q. Well, after that time, didn't you receive the amount of the monthly estimates, and were not the estimates accurate statements of the progress made under the contract by its terms?

A. No, they were not.

Q. In what particular?

A. I will take, for instance, in the central drain. The central drain was never estimated up to its value. I didn't take the measurements of the Tunnel, but the drain was simply estimated at so much per linear foot of Tunnel. At the time we accepted the contract there was a clause providing for keeping back \$1,000,000. The Resolve of 1873 reduced that amount to \$350,000; but by the



short estimates of the engineers the aggregate result was that a much larger amount was held back from us than the Resolve of 1873 named as the maximum amount.

Q. You mean to say, that by your construction of the Resolve, you were to have every dollar that was due you from month to month, reserving \$350,000 in the hands of the State?

A. Yes, sir; that is exactly our interpretation, and always was from the first.

Q. Where were they to get the estimates upon which the monthly payments were to be made, except from the contract?

A. I don't know where they were to get them. We were to be paid up all but \$350,000; they could arrange that any way they liked, I suppose.

Q. Have you based your petition upon that idea?

A. We have based our petition upon that idea, that after the passage of that Resolve of June, 1873, the maximum amount of the security fund was to be \$350,000; never to be more than that. We may be wrong in our idea of it, but that was always the interpretation we put upon it.

Q. If I understand your statement, you start September 1, 1874, with "Amount behind, or not earned, \$309,711"; "total amount of contract, \$4,594,268"; "to September 1st, amount earned per estimates was \$4,284,557." You mean by the estimates of the engineers?

A. O yes; of course.

Q. That you had received?

A. Well, no; we had not received that. There was always a certain amount kept back by the State. The engineer estimated that; he didn't keep it back, the treasurer did; we didn't receive it; there was always twenty per cent. taken off. The engineer's estimates had been *earned* but not *received* in full.

Mr. ALLEN. I should like to put in that Resolve of 1873. It is chapter 48, and is as follows:—

"*Resolved*, That the sum of two hundred thousand dollars, represented by said certificates [referred to in the first clause] shall be reserved and retained in the treasury of the Commonwealth, and an additional sum of one hundred and fifty thousand dollars, until the final completion of the said contract, and acceptance of the work by the governor and council; and that, subject to the said reservation, the full amounts already earned or hereafter to be earned by the Messrs. Shanly, shall be paid over to them."

Q. (By Mr. TRAIN.) Now, to come back to your exhibit: "September 1, 1874, amount behind or not earned, \$309,711."

Now, can you distinguish between the amount then “behind” and the money “not earned”?

A. No, I can't distinguish.

Q. Then, on September 1, you charged the Commonwealth with \$309,711 that you had not earned?

A. We did not charge them with it.

Q. In this memorandum, I mean?

A. Yes; there was that much earned.

Q. That would hardly be a mode of settling between man and man, would it? If it was not earned, you were not entitled to put it into the sum-total on which you were entitled to draw interest?

A. O no; we didn't do that.

Q. “Amount then behind, or not earned,	.	.	\$309,711	00
And also the security money,	.	.	350,000	00

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Total amount back, September 1,	.	\$659,711	00”
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You start with that \$659,711?

A. If you will read on, you will observe that we make certain deductions.

Q. [Reading.] “To have completed the contract work of Tunnel, except the track, would have required about . . . . . \$50,000 00

And had the work been taken off contractors' hands on 1st September, doubtless some deduction for track not laid, etc., would have been made then as was made on 22d December, . . . . . 36,547 00

And interest due the State, \$31,620, on 22d December, would then have been about . . . . . 25,000 00

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\$111,547 00

Had they not been hindered, the contractors hold, that on 1st September they would have been in position to claim payment of \$548,164.”

A. Yes.

Q. Now, what did you want to say? You wanted me to read on further. Didn't you start with the assumption, that on the first day of September we owed you \$309,711, which might or might not have been earned, and you couldn't tell which?

A. O no. I didn't proceed upon that assumption; you are wrong there. That much was still behind on the contract, and we had certain expenditures to make to complete the contract, and they would have to come out of that sum of \$309,000.

Q. You say you cannot tell whether it had been earned or not. I want to get at the theory upon which you make that assumption?

A. I know that all it cost us to finish the Tunnel after September 1, was \$50,000, or rather under; that is what I know. I know that as a fact; since then it has been completed for that amount, or less.

Q. But you never finished it?

A. That is another question altogether.

Q. Do you mean to say, that all the work you done after the first of September amounted to only \$50,000?

A. All the work under our contract was under \$50,000.

Q. And then you go forward, making monthly rests after September 15?

A. Of course, if my starting-point is right, the rests must be right, because those were the dates on which we got the money from the State.

Q. In October, you received \$33,900; in November, \$81,000; on the 15th of December, \$20,500; leaving a balance due on the 15th of December, of \$412,764; and on that you have computed interest at what rate?

A. Eight per cent.

Q. Why do you compute interest at eight per cent.?

A. Because we hold the money was worth that to us. We always had to pay that for it.

Q. Yes; but you were to pay interest at the rate of five per cent. on all the money the State charged to you. Why didn't you apply the same principle in making up this account?

A. O, I don't think because the State generously lent the money to us at five per cent. we can afford to lend money to the State at five per cent. Individuals don't do that sort of thing.

Q. Then, in that case, what is "sauce for the goose is not sauce for the gander"?

A. No, certainly not; it was an act of generosity on the part of the State; it was only taken as such.

Q. There never was any agreement between you and the State, by which you were to pay interest?

A. No, never, except the Resolve of 1873.

Q. Then you are remitted to the law of the land?

A. I don't know how that is. I wish you to understand one thing, that we do not put that into our petition as a *claim*; we simply ask it of the State; it is not a claim; we are not saying, "You must pay us that." It is not a right; we do not put it in that way; we ask it as a favor.

Q. In the absence of any agreement between the parties, the legal rate of interest in this State is six per cent.?



A. Well, the State need not pay us a cent if they don't choose ; that is just the way it is ; we don't claim that as a right.

Q. I understand that ; but I want to understand, and I want the Committee to understand, the nature of your claim ?

A. I believe if the State is going to pay us that at all, they will pay us what the money was worth to us ; that's what I think.

Q. Between individuals, the true mode of getting at the difference of interest would be to charge you five per cent., and you charge the State six. It would be a difference of one per cent., wouldn't it ?

A. Yes, sir ; if the matter is to be argued legally, of course, that is the view to take ; but we do not make even a legal claim upon it. I may say the same in regard to every claim after No. 6, in that petition.

Q. You might just as well come here and ask for anything else as ask for eight per cent. ?

A. We don't ask anything at all as a matter of right after item No. 6 ; we ask the rest only as matters of generous consideration on the part of the State, not as matters of right at all.

Q. Now, you say, further along in this memorandum : " By Resolve enacted by the legislature in 1873, it was ordered that the security-money retained from the contractors should thenceforward not exceed \$350,000. This enactment was not carried out towards the contractors ; and on 1st September, 1874, the amount held back from them, had they been allowed to finish their contract then, would have been \$548,164." Now, I find that the contract requires that, " for the purpose of determining the amount earned by the parties of the first part, from time to time, as the work proceeds, and for no other purpose, the following list of prices shall be taken as a basis of computation." Now, after the passage of that Resolve, the engineers continued to furnish their monthly estimates under that provision, as they had before that time, didn't they ?

A. They did.

Q. And you were paid in the same way ?

A. We were, in exactly the same way.

Q. And all you claim now is, that those monthly estimates were short of what you actually earned during those months ?

A. Yes, we do.

Q. You claim that you were defrauded by the engineers not returning all the work that you did for a given month after the passage of that Resolve ?

A. We never used the term " defrauded," but we do hold that they read that Resolve quite differently from what we read it ; that's about all.

Q. That is to say, suppose you were required to make eighty

feet progress from the central shaft in either direction, and for that you were to receive fourteen dollars a cubic yard, suppose you didn't make any progress at all in the central shaft, but did make more progress in the eastern section than the contract called for, then you claim that you should have been paid all that you had earned, working in the eastern section, at what price?

A. We hold that under that Resolve we should have been paid month by month fully up for everything, save what would be a sufficient amount to finish the Tunnel. Each month there should have been kept behind sufficient to finish the Tunnel, whether it was \$10, \$100,000 or \$500,000.

Q. Then you hold that that contract, after the passage of that Resolve, was to be disregarded?

A. Precisely; we hold that the Resolve suspended the contract; that is just it, precisely.

Q. And that the engineers were bound to measure up anything you chose to do, under the contract, from month to month, and return that to the governor and council, upon which your monthly payments were to be based?

A. Not just that; about as you say. We thought that in order to give active effect to that Resolve, the true way to measure would have been, not what we *had* done, but what was *to be* done, and to keep back enough from us to insure the full and proper completion of the Tunnel. That was what we thought; and, as a matter of fact, I will state, that one month, when we complained grievously of the large stoppages made from us, the engineers gave us \$81,000, when we had done only \$20,000 worth of work. It was last October estimate. We said, "It is too bad; you are keeping this money back from us," and then they gave us that amount. There may have been no way of "getting at it," but they gave us that money; so that, as a matter of fact, they put, at that time, practically about the same interpretation upon that Resolve that we had always put upon it.

Q. (By the Committee.) Do I understand you to say that your contract required a certain amount to be done to the central shaft and a certain amount to be done all along?

A. Yes.

Q. If you did not do anything at the central shaft, if you did 160 feet at the east end when the requirement was 80 feet at the east end, then they only paid you for 80 feet?

A. No; they paid us the monthly estimates fully, or supposed to be fully, for what we did do.

Mr. TRAIN. The difference in price would make a difference in the amount which they received. If they worked in the eastern

section they got \$11 a yard; if they worked from the central shaft east and west they got \$14 a yard.

WITNESS. Of course it was for our interest to drive the central headings, because there we had the largest price; we simply didn't drive them, because we couldn't; but, as a practical result, they were driven, because the headings were after all done in time, and the whole Tunnel done in time.

Q. You claim that you lost a large sum of money because you were not allowed to work east?

A. After we struck so much water on the west we were only able to work east.

Q. Do you claim that you lost a large sum of money by that?

A. I do.

Q. How much?

A. We were in such a position by water that all the work we could do in the shaft was on the east advance; we couldn't do anything else.

Mr. TRAIN. He was never forbidden by anybody; the gentleman used the word "allowed," which would seem to imply that he was forbidden by somebody to work east.

Q. What do you claim you lost by that?

A. \$4,353.38.

Q. Is that all? If you had had your way about going east, is that all you would have saved?

A. Yes, sir; in the driving of the heading.

Mr. TRAIN. That is perfectly simple, and I think Mr. Shanly and I both agree about it. The contract required that Mr. Shanly should work from the central shaft east and west at the rate of 80 feet per month. He never did that, because, as he says, he was obstructed by the water, but he worked this way and worked that way. Now, if he had performed his contract, making his 80 feet per month east and west from the central shaft, he would have got \$14 a yard for that excavation; instead of that, working this way, he got but \$11 per yard; that makes a difference in his monthly estimates.

Mr. ———. I think he spoke of having had a large outlay for pumps and no hoisting going on.

Mr. TRAIN. He did; but his pumps were not enough, notwithstanding.

Q. What I want to get at is, what you claim as damages because of the water?

A. We suffered to the extent of \$217,204.49 by reason of the water in the central shaft.

Q. And if you had gone east you would not have met that loss?

A. If we had not been forced to go *west* for a certain distance.

Q. (By Mr. TRAIN.) You say that your whole loss by water was \$217,000 ; will you tell me what it would have cost you to put in pumps to take out that water, so that you could have done your work according to your contract?

A. It is very hard to say what it would have cost us ; no person would have known what pumps would have been required. You must tell me how many would have had to be put in first. No person could know how much water was likely to come in, and I cannot tell how many we ought to have put in there to provide for possibilities. If we had been forced to drive that west heading all the time, there would not have been room enough in that shaft for all the pumps necessary to keep it free of water and carry on the work at the same time. After we did get into that west heading there was a free run for the water eastward, and the water kept increasing enormously as we went west. No person could have calculated how many pumps it would take to keep it clear. It increased from 80 gallons a minute to 200 in a very short distance, and no person could guarantee that it would not be 400 in a short time, if we had persisted in working west.

Q. What was the largest flow of water there?

A. I think it was 200 gallons and something over.

Mr. ALLEN. It was 320, the largest that was measured ; but that was before the headings were joined. They did not measure after the headings were joined, because then it ran out.

WITNESS. Before answering that question we would want some limit fixed upon as to the number of pumps that would be certain to do the work ; no person could tell.

Mr. ALLEN. 320 gallons per minute was the largest amount that Mr. Wederkinch gave in his letter.

Mr. TRAIN. You actually pumped over 200 gallons per minute with what pumps you had, if I recollect right.

A. Yes, sir ; over 200 gallons, pumping and baling.

Q. So that, upon all the evidence we have, you would not have had to duplicate your pumping-power to have kept the shaft clear?

A. O yes ; more than that.

Q. 320 is not double 200, is it?

A. No ; but after we cut through at the east end we went to the west heading, and it didn't then require so much pumping, because the water ran off. Pumping 20 feet high is a different thing from pumping 1,000 feet.

Q. How much did you pump and run out over the bench?

A. I never measured it ; there was no occasion to measure it.



Q. Where was that water pumped that was measured, 320 gallons a minute?

A. Up to the top of the shaft.

Q. Did it all come from the pumps?

A. No; we had to bale also. We had to turn our hoisting machinery to baling, to supplement the pumps.

Q. Is that included in the 320 gallons?

A. That is included. Mr. Wederkinch, who had charge of the shaft for Mr. Frost, took great interest in statistics, and kept a very careful record of it. I did not keep it myself, but he was there very constantly, night and day, and took a great interest in it, and kept it carefully. He would know what the pump would throw out per stroke, and if the pump was running twelve strokes a minute, it would throw out just about its capacity per stroke multiplied by twelve. The pumps threw out 200 gallons a minute, and we were baling constantly besides.

Q. You have no idea how much runs out of the Tunnel now?

A. No; I can't state that. There was a large quantity struck in the west end of the Tunnel, besides what central workings gave.

Q. Have you any idea how much it increased?

A. I think there are now 1,200 gallons running out of the Tunnel.

Q. 320 gallons is the largest amount that you ever experienced?

A. No; we experienced about 237 gallons of pumping. That is what we experienced of pumping at the heading, I mean. Of course, when we came to pump over that bench, and advanced in the heading we gained a great deal more. In November, 1872, after we entered upon work westward again, we pumped 320 gallons, and as we advanced in the west heading the water was coming upon us all the time.

Q. Then the 320 gallons a minute was the water that ran over the bench?

A. Yes, sir; it was nearly 100 gallons over what we pumped to the surface.

Q. When you pumped 320 gallons a minute, did that keep the water down so that you could work?

A. O yes, it was very easy; there was no trouble about that; thirteen feet was all we had to lift it; we could pump 1,000 gallons a minute without any trouble.

Q. (By Mr. TRAIN.) As I understand it, 320 gallons was the maximum?

A. With that pump; yes, sir. But it is not the maximum we got at the west heading, because we got a great deal after pumping ceased to be necessary. As soon as the bench was out no person

took any trouble to measure the water then. I don't know what the total quantity struck was. One day we struck a stream like the Falls of Niagara there.

Q. (By the Committee.) What would another pump have cost there?

A. \$50,000, and a little over.

Q. Would not another pump have pumped out this water at the time you were baling?

A. O no. If we were not forced to go on with the west heading, it would; but if we kept at work on the west heading, it would not.

Q. It would have saved baling?

A. Yes, sir. But the difficulty was this: the trouble of getting in the pump interfering so much with the work we were doing. The mere pump itself and engine would not have cost \$20,000, but the difficulty was the trouble of getting another pump in. It is very expensive to put a pump in.

Q. What was the objection, on the part of the Commonwealth, to allowing you to go east?

A. There was no objection to working east. The engineers said, "You are obliged to go 80 feet in west heading per month, and you must go that 80 feet."

Q. When did you strike water?

A. It was the 12th day of February, 1872, when we first had to suspend work westwards, after getting in large pump.

Q. You finally suspended, in consequence of water, in May, 1872?

A. Yes, sir.

Q. (To Mr. ALLEN.) So that you had only seven months when there would have been any need of pumps there?

A. Yes, sir.

Q. And it would have taken how long to have put those pumps in?

A. I suppose about six or seven months.

Q. So that, by the time you had got the pumps well going, it would have been about the time that you joined the two headings, as it was?

A. Yes, sir, about.

Q. So that there was no use in putting in the pumps, because you would have had no occasion to use them after you got them completed,—or, at any rate, not more than a month or two?

A. No.

Q. (By Mr. TRAIN.) Then I don't see but what you make out now, in reply to Mr. Allen, about an even thing. If you had put in the pumps, and done the work according to the contract, it

would have taken you about six or seven months; and you did the work, as it was, in about six or seven months?

A. There was just this difference. When you got out east, you knew you were safe; nothing could fill the shaft then; but no person could tell whether another pump would do any good or not.

Q. That does not answer my question. Mr. Allen makes you say that it would have taken six or seven months to have put in a pump, in order to keep that "sump" clear; and you got water running out of the eastern end of the Tunnel in about the same length of time?

A. And so much work done. Putting in the pump would not help the State, but it helped us considerably to do the work in the way we did it.

Q. Then you ought to pay the State something for not obliging you to put in another pump—isn't that it?

The CHAIRMAN. His meaning was that he saved his pump.

Mr. TRAIN. He did save it, and that is just what I complain of. He saved the expense of that pump, \$50,000, and he charges us with \$217,000.

WITNESS. That just finished the Tunnel; but if we had been forced to proceed in the other way, the Hoosac Tunnel would not have been finished to-day, if ever; the shaft would have been filled with water.

Q. (By the Committee.) The object in your mind was to finish the Tunnel in a certain time?

A. The object in my mind was, that within a certain time we had to finish the Tunnel, or forfeit everything in the hands of the State, which, when the time came, would have been over a million dollars. Our object was to finish the Tunnel.

Q. Then what object had the State in forcing you to drive the work at the west heading?

A. They said, "You cannot finish it unless you drive west." Not the State, of course, but the engineers. They said, "You will never do it, unless you drive that west heading. You can't get through." I say, we have proved that we did get through. We suspended work there, and came before the governor and council, and at last they allowed us to continue the stoppage of May, 1872.

Q. (By Mr. TRAIN.) There is no evidence of any such action, is there?

A. There was no action, that I know of. We got no further trouble westward after May, but were tacitly allowed to go on our own way.

Q. I know; but there was no action of the governor and council, relieving you from that obligation?

A. I don't know of any at all; they tacitly allowed it; we explained the risk, the danger of filling the shaft, and Governor Washburn and the honorable council saw there was danger, and that our plan was the best; and we never did any work in that west heading after the 12th of May, 1872, until we broke through east, and then away went the water, and immediately after breaking through, we started this west heading again.

Q. (By the Committee.) If it is admitted that the whole job was taken at a lump sum, how can these various prices enter into the estimates?

A. In order to make out the monthly estimates, the contract distinctly states that the engineers shall make monthly measurements of the work done on the Tunnel. We took it with that understanding; and in order to enable them to make the estimates, as is a very common thing in bulk contracts, the contractors and engineers agreed upon a schedule of rates whereby to determine the monthly value of the work done. They agreed upon a schedule of rates to be applied to the quantity of rock taken out each month.

Q. Was this the schedule of rates upon which you figured?

A. Yes, sir. We made those up for our item bid, and then they adopted our figures, of course, as the schedule rates for making the monthly estimates on the bulk-sum contract.

Q. (By Mr. TRAIN.) Now, will you look and see if that is a true copy of the statement you made to the governor and council, when you made your final settlement?

A. I think it is; it looks very like it; it is the same, no doubt.

Q. You finally settled with the governor and council, in December last?

A. Yes.

Q. And several of the claims which now appear upon your petition had been submitted to the council in that settlement, and rejected by them?

A. I think all. I mean they were all submitted.

Mr. TRAIN. I will read that statement now:—

#### COMMONWEALTH OF MASSACHUSETTS.

EXECUTIVE DEPARTMENT, COUNCIL CHAMBER, }  
BOSTON, December 22, 1874. }

A communication was presented by Messrs. W. & F. Shanly, as follows, to wit:—

NORTH ADAMS, 21st December, 1874.

To the Hon. THOMAS TALBOT, *Governor, etc.*

SIR:—We beg leave to announce to your Excellency and the honorable council that we have completed all our work in the Hoosac Tunnel under the contract of 24th December, 1868, save and except the laying of



the track and the covering of the central drain, deductions for which have been agreed upon between ourselves and the engineers.

We now respectfully ask for a settlement and payment of balance found to be due us.

Your obedient servants,

W. & F. SHANLY.

COUNCIL CHAMBER, BOSTON, December 22, 1874.

The Committee of the Council upon the Troy and Greenfield Railroad and Hoosac Tunnel have considered the matter of a settlement with Messrs. W. & F. Shanly, under their contract with the Commonwealth, and report that it is advisable to make such settlement "without waiting for the laying of the railroad track through the Tunnel," as authorized by chapter 365 of the Acts of the year 1874.

Proceeding upon this basis we find the account to stand as follows:—

Gross amount of the contract, . . . . . \$4,594,268 00

And the payments and other deductions to be as follows:—

Paid in 1870, . . . . .	\$732,547 31	
in 1871, . . . . .	745,358 24	
in 1872, . . . . .	888,318 38	
in 1873, . . . . .	1,057,490 23	
in 1874, including payment of Decem- ber 15, . . . . .	637,967 28	
Interest on advancements under Resolve of 1873, chapter 48, . . . . .	31,620 40	
Deduction on account of railroad track through the Tunnel not laid, . . . .	32,031 60	
Deduction on central drain, east, not com- pleted, . . . . .	4,515 94	
877,422 brick, at \$9, . . . . .	\$7,896 80	
52 yards of brick-work laid, . . . .	507 00	
	<hr/>	
	8,403 80	
	<hr/>	
		4,138,253 18
Balance, . . . . .		\$456,014 82

The contractors present a claim for extra work, amounting to \$70,404.53, embracing eleven items, a copy of which is hereto annexed. [See pp. 61, 62.] On an examination of this claim we find as follows:—

ITEM 1. We do not find that this item is not embraced in the contract. The schedule annexed to the contract recites that the work already done at the east end "consists of a Tunnel extending into the mountain from the east portal about 2,500 feet, a portion of which has been enlarged to the full height of 20 feet, and the width of 24 feet." And the work to be done is the "enlargement of Tunnel to full size of Tunnel section required. Estimated amount, 4,500 cubic yards." We find nothing in the contract that specifies, in feet, what portion of the 2,500 feet had been

enlarged to the full height and width. The estimated amount in cubic yards of rock to be removed is merely an estimate, for which the contract expressly recites that the Commonwealth is not to be responsible. We, therefore, reject this item as a legal claim.

ITEM 2. The contract provides that the material removed from the Tunnel will be deposited wherever the Commonwealth, by its officers in charge, shall direct, with a limitation that the contractors shall not be required to haul the same more than 3,000 feet from either end of the Tunnel. A small portion of the material, the grading of which is charged for in this item, was deposited by the contractors while the work was in charge of Mr. A. R. Field, who is now deceased; and the Commonwealth is unable to show what directions, if any, were given to the contractors by him; but much the larger part of such deposit was made under the direction of the present engineer, and grade-stakes were set, showing the height to which deposits should be made. The work charged for became necessary by reason of the failure of the employes of the contractors to conform to the requirements of the engineer, who repeatedly called their attention to the matter. Under these circumstances, the Committee are of the opinion that for such portion of the grading-work as became necessary, by reason of such failure to conform to directions, the contractors are entitled to nothing; but for such filling as was performed before proper grade-stakes and directions were given, the contractors should be allowed the sum of six hundred dollars, which, from the evidence before us, we deem to be a fair compensation for the work required.

ITEM 3. The charge contained in this item stands almost precisely similar to Item No. 1, and is rejected for the reasons therein given.

ITEM 4. This item is regarded as coming within the principle adopted by the legislature on the subject of arching the Tunnel, and is allowed.

ITEM 5. This charge was authorized by order of the governor and council, and is allowed.

ITEM 6. This item is rejected, for the reason that the Commonwealth had no such interest in the alteration and improvement of compressors as called for any expenditure of money.

ITEM 7. The change from "dry" to "cement" masonry on the central drain, west, was duly authorized, and the charge for difference in cost is believed to be just, and is allowed.

ITEM 8. By reason of unexpected difficulties in obtaining a suitable foundation for the façade, more masonry was required in its construction than the contract called for; and directions were given accordingly. This item is, therefore, allowed.

ITEM 9. The Commonwealth may be justly chargeable for something under this item, but as the contractors give notice that they shall apply to the legislature for relief for the loss of interest growing out of the same matter, we have not thought it advisable to recommend any allowance under this item. We therefore reject it, inasmuch as the legislature is to be asked to pass upon the matter.

ITEM 10. This item is for the removal of loose rock outside the lines of the Tunnel, which was rendered necessary, in the opinion of the engineers, for actual safety. The work here charged for is believed to

be required by the terms of the contract. For this reason, no allowance is made thereon.

ITEM 11. The work here charged for became necessary by reason of the flooding of the arch by the breaking away of the mountain stream during the great storm of October, 1869, by which considerable material was carried into the arch for a considerable distance. It was necessary that this material should be removed to enable the contractors to lay their track and complete their work. The governor and council have always regarded the contractors as being liable to perform this work. The charge is therefore disallowed.

In recapitulation, we find the account to stand thus:—

	Disallowed.	Allowed.
Item 1, . . . . .	\$3,582 20	—
Item 2, . . . . .	3,511 18	\$600 00
Item 3, . . . . .	8,694 23	—
Item 4, . . . . .	—	8,340 68
Item 5, . . . . .	—	6,930 00
Item 6, . . . . .	1,205 45	—
Item 7, . . . . .	—	4,971 00
Item 8, . . . . .	—	6,273 79
Item 9, . . . . .	2,700 00	—
Item 10, . . . . .	22,246 00	—
Item 11, . . . . .	1,350 00	—
	<hr/> \$43,289 06	<hr/> \$27,115 47

STATEMENT OF CLAIMS FOR EXTRA WORK BY W. & F. SHANLY & CO.,  
HOOSAC TUNNEL CONTRACT.

- Trimming and enlargement of Tunnel for  
800 feet from east portal, . . . . . \$3,582 20  
(The specification describes this portion of  
the Tunnel as completed.)
- Grading embankments, east end, . . . . . 4,111 18  
(Actual cost of grading for permanent track,  
north, and for "county" or "town" high-  
way south of Deerfield River.)
- Central drain, from east portal to 5,017, . . . 8,694 23  
(This portion of the drain, east, was, ac-  
cording to the specification, assumed to be  
finished, all but the covering.)
- Brick arching and excavation at 5,850, east, 8,340 68  
(Thirty-nine feet long,  $8\frac{1}{2}$  cubic yards to the  
foot, at \$12 per yard; 125,000 brick at \$32.)
- Excavation for arching per O. C., 28th July,  
1874, . . . . . 6,930 00  
(As per agreement.)

6.	Alteration and improvement of compressors, . . . . .	\$1,205 45	
	(Actual outlay.)		
7.	Difference in cost between "dry" and "cement" masonry, central drain, west, .	4,971 00	
	(Actual outlay on.)		
8.	Additional work and extension of façade, .	6,273 79	
	(This agreed for.)		
9.	Increased expenses incurred through being deprived of way through Haupt Tunnel, .	2,700 00	
	(The very least sum at which we can put the extra expense caused by destruction of Haupt Tunnel.)		
10.	Taking down loose rock, . . . . .	22,246 00	
	(In support of this claim we point attention to the fact that the Tunnel throughout has been considerably larger than contract dimensions, and that such enlarged size will largely benefit the State wherever brick arching may hereafter have to be done.)		
11.	Cleaning out the Farren arch, . . . . .	1,350 00	
	Total amount of extra work, . . . . .	—————	\$70,404 53

And the following items will be submitted to the legislature, asking whether they may not be equitably considered and granted:—

1.	Excess of actual over assumed measurement of rock, . . . . .	\$21,977 50	
2.	Damage and loss arising from great storm of October, 1869, . . . . .	18,000 00	
	(Included in this, we ask consideration for the heavy loss sustained through being deprived of railroad connection with east end.)		
3.	Loss of interest since 1st September, 1874, .	18,000 00	
4.	Remission of all interest on advances from drawback, . . . . .	25,000 00	
	(These interest calculations are only approximate, as the dates to which they are to be brought up are not yet ascertained.)	—————	82,977 50

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\$153,382 03



Mr. TRAIN. In that connection, I want to put in the report of the committee of the council, with the orders thereupon:—

The Committee recommend that there be allowed and paid to Messrs. W. and F. Shanly the balance found due on their contract, after making the deductions as stated, to wit, \$456,014.82, and the further sum of \$27,115.47 for extra work as above stated. They report, for adoption, the following orders in conformity herewith.

MILO HILDRETH,  
GEO. WHITNEY,  
GEO. O. BRASTOW,  
RUFUS S. FROST,

*Committee.*

The foregoing Report is accepted and adopted.

*Ordered*, That the sum of four hundred and fifty-six thousand fourteen  $\frac{82}{100}$  dollars be allowed and paid to Messrs. W. & F. Shanly, contractors for the completion of the Hoosac Tunnel, in settlement for the balance found due on said contract after making deduction for payments made, and for railroad track not laid, etc., as per report of the committee of the council this day adopted, and that a warrant be issued accordingly, said payment to be made upon the surrender of all outstanding certificates of conditional indebtedness heretofore issued.

Adopted.

*Ordered*, That the sum of twenty-seven thousand one hundred and fifteen dollars and forty-seven cents be allowed and paid to Messrs. W. & F. Shanly, contractors for the completion of the Hoosac Tunnel, for extra work performed by them in connection with their contract, as per report of the committee of the council this day adopted, and that a warrant be issued accordingly. And it is ordered, that the sum of \$15,270.68 of the aforesaid sum be placed against the appropriation of \$300,000 for the arching of the Tunnel as made in chapter 365 of the Acts of the year 1874, and the balance of said sum against the unexpended general appropriation for the Troy and Greenfield Railroad and Hoosac Tunnel.

Adopted.

COMMONWEALTH OF MASSACHUSETTS.

SECRETARY'S DEPARTMENT, BOSTON, Feb. 12, 1875.

A true copy. Attest:

(Signed) —

OLIVER WARNER,  
*Secretary of the Commonwealth.*

Mr. TRAIN. I also put in a copy of the receipt of the Messrs. Shanly, as follows :—

We, W. & F. Shanly, contractors for the completion of the Hoosac Tunnel, hereby acknowledge to have received payment of the Commonwealth for the balance due upon our contract with the Commonwealth, after making certain deductions on account of railroad track not laid, etc., the same being in full settlement of all claims against the Commonwealth, except certain equitable claims, for which we propose to ask relief from the legislature. And in pursuance hereof we have surrendered to the Commonwealth the said Tunnel, and all property in our hands belonging to the Commonwealth.

(Signed)

W. SHANLY.

F. SHANLY,

*By his Attorney, W. SHANLY.*

No date. Money paid, as per receipt on warrant, Dec. 23, 1874.

#### RE-DIRECT.

Q. (By Mr. ALLEN.) You say that before you entered into this contract with the State, you were aware of President Hitchcock's opinion in regard to the probability of water being found in excavating the Tunnel?

A. Yes, I had a general knowledge of his views.

Q. I want to ask you what your own opinion at that time was in regard to the probability of meeting water?

A. My own opinion was, that the same kind of rock which was encountered at the east end, would extend over west of the summit, and that rock was perfectly dry rock, and the external indications of the mountain would lead any one to suppose that the rock was the same all the way from the east end to the west summit.

Q. When you got to the bottom of the central shaft, in August, 1870, won't you state whether there were then any indications that led you to expect a great influx of water as you proceeded westward?

A. Not the least; the rock was even more dry than I anticipated in the central shaft, all the way to the bottom. It was what might be called almost perfectly dry ground.

Q. I understand you to have said that the place where you struck water in some considerable quantity was at a point about 170 feet west of the central shaft?

A. Somewhere thereabouts, I think, was where we first struck it.

Q. You then made provision for putting in additional pumps?

A. We did; we put in a very large pump?

Q. Were the pumps that you then provided large enough, in

your opinion, at that time, to pump out all the water that you were likely to meet?

A. In our opinion those pumps were sufficient for all the water that could be properly combated in that shaft; if the shaft was to be worked for hoisting purposes and pumping purposes both, we could not have done better than we have done in that shaft, with pumps. If the object was merely to pump water, it was another question; but that shaft was used for a double purpose,—we were to hoist rock and pump water too.

Q. What was the cost of those pumps?

A. The large pump cost us about \$55,000 or \$56,000 when it was ready for work. The putting in is a much more expensive matter than the pump itself.

Q. The cost of that pump, as I understand, \$55,000 or thereabouts, is not included in this sum of \$217,000 that you consider you lost?

A. O, no; that was a legitimate outlay of our own. We had to put the pump in, of course.

Q. That expense of \$55,000 is in addition to the \$217,000?

A. Certainly; O, yes.

Q. (By Mr. TRAIN.) Then you mean, that notwithstanding you expended \$55,000 for a pump, the damages were still \$217,000?

A. O, yes; those damages were incurred after that pump was in, and after we had been told that we must go on with the west heading. We charge this \$217,000 to being forced into that west heading.

Q. You do not mean to add the cost of the pump to the \$217,000?

A. Not at all. I would not have said a word about the pump, if there had not been anything more; that was all right; that was part of our legitimate risk.

Q. (By the Committee.) Was there another pump put in?

A. O, yes; we put in another pump afterwards.

Q. Is that included in the \$217,000?

A. Yes; that is in the \$217,000.

Q. What was the cost of that?

A. It was a very small pump, and cost us about \$20,000.

Q. (By Mr. ALLEN.) You spoke the other day about finding that the foundations at the central shaft were not safe after this large pump was put in to allow of the steady working of the pump, so that you had to relay the foundations?

A. We did. After we got our large pump finished and working, the old foundations that were in there began to give way, and we had to stop and take out the upper works of the pump and put in

new foundations. However, that is part of the original cost of the pump, and is not included in this item. We considered that part of our proper risk.

Q. But it delayed you a couple of months, for all that?

A. Yes, it did; it took two months out of us.

Q. There was a receipt that you gave for damages at the west end for the amount that you received, \$3,305, on account of the damages caused by the flood, dated in January, 1872. At the time of giving that receipt, you sent a letter to the governor and council?

A. O, no.

Q. Well, to Mr. Frost?

A. Yes, to Mr. Frost.

Q. Is this a copy of the letter?

A. Yes, sir, it is.

Mr. ALLEN read the letter as follows:—

NORTH ADAMS, 23d January, 1872.

DEAR SIR,—To obviate any danger or misunderstanding in respect to the \$3,305.19, paid us to-day for work done by us in repairing damages at west end of the Tunnel, consequent on the running stream of 4th October, 1869, we desire to state now, as we have already done before the council, that we accept the payment without prejudice to our claim.

Yours truly,

(Signed)

F. SHANLY & CO.

BENJAMIN D. FROST, Esq., *Engineer*.

#### RE-CROSS.

Q. (By Mr. TRAIN.) In the \$55,000 which you put down as the cost of the pump, you included what you expended for baling?

A. O, no; we had not commenced to bale, Mr. Train. We began baling after the 17th of November. Of course, everything we had to do to keep the shaft free of water while we were putting the pump in, was part of the cost of getting it there.

Q. That you included?

A. Of course; that is, baling during the period that elapsed from March to October, until we got the pump in—that period of keeping the shaft dry.

Q. You included that in the cost of getting the pump in?

A. Yes, sir; very much the larger part of the cost of the pump consists in the expense of getting it in.

Q. What was the cost of the pump?

A. The castings alone cost about \$9,000; then we had to finish



them in our shops. I don't know the exact cost ; but I suppose the pump, with all the material, cost about \$20,000 or \$25,000.

Q. Then the expense of putting it in was about \$35,000?

A. Yes.

Q. Was that a six-inch pump?

A. O, no ; that was an eleven-inch pump.

Q. When you took the contract there were two pumps there, as I understand it, belonging to the Commonwealth?

A. O, no ; there were no pumps.

Q. There was a four-inch pump, wasn't there?

A. O, there was a little thing, but it was of no use ; there was a little four-inch pump, but it didn't amount to anything as a piece of machinery.

Q. Did you charge the Commonwealth for replacing that pump with a six-inch pump?

A. No, sir ; we replaced that little old pump, which was there for shaft purposes, with a five-inch pump. It was not a four-inch pump. They never had a four-inch pump ; it was less than four-inch ; it was only for half the shaft.

Q. Now in regard to this matter of foundations?

A. We have not made any claim for that at all. I merely mentioned it as incidental to the cost of the pump.

Q. The foundations that were there were intended for a much smaller pump than you put in?

A. Yes, of course ; that was a part of our risk ; we do not make any claim for that ; it was unfortunate that we lost two months by it, that is all.

Q. (By the Committee.) Do you claim this \$217,000 damages for being delayed by water? Do you make any claim upon the State for that?

A. We do not make any claim in that way ; we mention it as one of the hardships we suffered.

Q. In your statement of the loss upon the Tunnel contract,—\$226,000,—I understand you to include \$5,000 apiece for each one of you?

A. Yes, sir.

Q. Was Mr. Francis Shanly at the Tunnel giving his services?

A. For four years he was there about the same as I was ; for the last two years he has not been there constantly, only when I wanted him. The last two years there was no occasion for both of us.

Q. But for six years and two months you reckon it at \$10,000 a year in the cost of the Tunnel?

A. It isn't six years yet. We were superintendents of the

work. Of course we would have had to pay that to ourselves or somebody else as part of the working expenses.

Q. (By Mr. TRAIN.) You were only engaged upon the work about five years and a half?

A. Well, we actually commenced in March, 1869, and left finally in December, 1874.

[Adjourned to Friday, at ten o'clock.]

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FRIDAY, March 12, 1875.

TESTIMONY OF BENJAMIN D. FROST.

Q. (By Mr. TRAIN.) You are the engineer of the Hoosac Tunnel, and have been for how long?

A. Since the commencement of 1868,—nearly seven years.

Q. Just state to the Committee your general duties in connection with that work?

A. Well, my duties for the first year were those, both of contractor and engineer, substantially; that is, on behalf of the State, to direct all the management of the work; under the order to prepare a contract, my duties were to make the specifications and estimate quantities; and after the execution of that contract, my duties were simply directory, to see that the stipulations of the contract were carried out by the contractors, and that the proper amount of money was certified. The quantities of work done by them were measured and certified to the governor and council.

Q. Had you any advising engineer or consulting engineer?

A. During the year 1868, Benjamin H. Latrobe, of Baltimore, was consulting engineer; he was consulting engineer when I went on the work. At the end of the year 1868, he sent in his resignation. He has stated in his published report to Governor Bullock certain reasons for his resignation. He also mentioned to me, privately, the difficulty of coming so far. For a time, I acted more directly and immediately under the advice of the governor and council, until, I think, in April or May, possibly, of 1869, when Mr. Laurie was appointed consulting engineer, and remained consulting engineer for two years, and was succeeded by Mr. Philbrick.

Q. Item 2 in Mr. Shanly's petition is for "grading embankments at east end." I wish you would state to the Committee, in your own way, what those embankments were, why the work was done, and why the charge for that grading was rejected? In this

connection, I will call the attention of the Committee to the clause in the contract which relates to that item:—

“The material removed from the Tunnel, at both ends thereof, will be deposited wherever the Commonwealth, by its officers in charge of the work, shall direct, it being understood that in case the contractors shall be required to deposit the same in embankment or spoil-bank on the east of the Deerfield River, they shall have the privilege of using the bridge to be erected by the Commonwealth under such reasonable restrictions as may be required; and the contractors shall not be required to haul the same more than 3,000 feet from either end of the Tunnel.”

A. It was obviously the duty of the engineer, as representing the Commonwealth, to see to it that so much of the material was made useful for filling up the low ground there,—first, for the purpose of building the railroad, and then for such occupation for side-tracks and other purposes, as might reasonably be anticipated to become hereafter useful.

Q. Wait a moment; you must not assume that we know anything about this business. You directed, I suppose, the contractors to do something with the material which they removed from the Tunnel on the east side. Now, will you state what directions you gave?

A. In the first place, to build the railroad bank for the 3,000 feet of distance, across part of which there was a filling exceeding thirty feet in depth, requiring a high embankment; and, in the second place, to build the highway. The old road across the State lands was very difficult and dangerous. The county commissioners had agreed with the old Tunnel commissioners who were in office in 1868, for the location of a county road up the Deerfield Valley, the whole length of the county, provided that the State would build the road across its own lands. The matter was finally arranged by the passage of an appropriation of \$1,500 by the legislature for building that road, and on the faith of that, the county commissioners went on and built the rest. But the road could not have been built for \$1,500, except it be understood that the greater part of this filling, where they went across low ground, thirty or forty feet deep below the intended grade, should be made by depositing the waste material from the Tunnel. So that these two objects were the first ones to which my orders to the contractors looked,—first, the building of the railroad bank; and second, the building of another long bank for this highway. I think it well enough to mention that at the outset, Mr. Laurie, who was then consulting engineer, was of the opinion that it was my duty, in the first place, under that contract, to press down a narrow railroad bank from the end of the

Tunnel down to the depot, for only the width of a single-track road-bed, on the ground that the bridge might possibly be carried away by high-water, or burned, and that in one of these ways a possible interruption in filling might occur when the State should want to build the railroad track up to the Tunnel; but he finally consented to have that order changed to build first the width of double-track road-bed, which I thought more appropriate, and that was the order under which the first year's procedure was made.

Q. Well, they proceeded to deliver that material under your direction, did they?

A. They did; and then came up the further question, that the contractors contended that inasmuch as there was eventually to be a very wide bank; evidently—

Q. I do not care about anything more than the conclusion at which you arrived.

A. Afterwards, my decision to limit them to a double-width bank was overruled at a hearing before the governor and council, at which they were allowed to carry out the filling to a greater width than two tracks.

Q. That change was favorable to them?

A. Yes, sir.

Q. How?

A. Because they could deposit their material more conveniently by carrying the bank forward with the width for three or four tracks. In this way, they found opportunity for dumping in different places at the same time.

Q. Now, in relation to the grading of that material?

A. Well, sir, it was commenced under the charge of Mr. Field, who was the engineer for the railroad; but at a certain time I took charge of the work, after his decease, and I found a little piece of the bank, which had been made first, to be built too high. Of course, Mr. Field having died, I had no means of knowing whether it was in consequence of some misunderstanding, or of his failure to give specific instructions, that the error occurred. At any rate, I took the work as it was, and proceeded to give the grades and the orders by which, as I expected, the filling would be kept below the necessary grade for receiving the ballast for the railroad track. The fact is, that the first superintendent there—I mean by that the contractor's superintendent, the managing man—depended very much on his own judgment. He said that the bank would settle, and he guessed that it wasn't worth while to disturb it. It was not very much above grade at the outset.

Q. You are talking of the small piece now?

A. Yes, sir; I mean the small length that was built at the time



I took charge of the work. He said it was not worth while to disturb that, because, in the lapse of years, there would be some settlement; but I think he was a little careless. It was a little more convenient to fill forward on a level than to follow the descending grade, and as often occurs on public works, the laborers were quite careless of directions. The result was a series of notices, first to the superintendent, and finally, when the matter was assuming too large proportions, to Mr. Shanly himself. The first presumption was, that the superintendent representing him on the work looked after his interests. It is the only way in which work can be carried forward. In the multiplicity of details and changes that must occur in the progress of any work, it must necessarily occur that the smaller details, the position of the stakes by which the various portions of the work are to be guided, and so forth, shall all be given to the man representing the contractor on the work.

Q. (By Mr. ALLEN.) Excuse me a moment. Were those notices in writing?

A. They were not in writing at first.

Q. Were they given by you personally?

A. They were given by my assistant.

Q. How do you know they were given,—were you there?

A. I was there every few days and saw the stakes.

Q. It is what you infer?

A. No, sir; I maintain that when I see a stake set by my directions, and have that constantly under my eye week by week, I know it.

Q. You are not testifying to any personal communication that you had yourself, either in writing or orally, with Mr. Shanly or with his superintendent?

A. I am. I said that when the matter assumed a persistent magnitude of neglect of the directions, I had then a right to presume that there was something wrong, by which I should go past the man who had the management.

Mr. ALLEN. I simply wished to find out if you were testifying from what you knew.

Q. (By Mr. TRAIN.) The result of it was, that this filling was above grade?

A. Yes.

Q. And afterwards they had to reduce these embankments to grade?

A. Yes, sir.

Q. And that is the work for which this charge is made?

A. That is it. There are two charges,—for the railroad and for the highway.

Q. It is all put together here?

A. Yes, sir; I say there are two quantities making up the amount charged.

Q. But they were all within the limits of the 3,000 feet?

A. Yes, sir; all under the clause under which I exacted the performance.

Q. (By the Committee.) This high grade was all made by Mr. Shanly?

A. Yes, sir; no one else could go there.

Q. (By Mr. TRAIN.) Was this piece of highway too high also?

A. It was, part of the distance.

Q. So that that had to be reduced?

A. That had to be lowered for part of its length.

Q. Then, in making the final settlement, \$600, I notice, was allowed by the governor and council for work that was done while Mr. Field was engineer.

A. It was simply because it was a matter of doubt; we couldn't say that there had been any directions given guiding the contractor. The object was to give a liberal amount that should cover that portion, so that I might positively assert that no loss had accrued to the contractors from that.

Q. I don't know as you stated whether the grades were given for the county road as well as for the rest of the work?

A. They were.

Q. In reference to item 3, I simply wish to ask you if you have gone over Mr. Shanly's figures in his statement, and can state whether they are correct or not?

A. Yes, sir. I should explain, in general terms, that that is made up of two items. Here is a memorandum which I made, and which will explain very briefly, and better than words would, exactly the result of that examination. I made the memorandum some days ago, with reference to this examination. It will be seen that it is all to the point:—

*Extract from letter to Attorney-General Train, March 11, 1875, concerning the Schedule referred to in the petition of W. & F. Shanly.*

"I will state, in general terms, that I have so far examined as to be able to state my full belief that the whole cost of the items, 1 to 6 inclusive, as described in the schedule, does not vary by any considerable percentage from the sum, \$42,083.61, which is the aggregate of Mr. Shanly's amounts. He has certain items shown, more costly than I can admit; but, on the other side of the account, I find the statement of other items to be made less than I know their cost to have been.

"It is only as to items, 1 to 6 inclusive, that the original vouchers of payment have been submitted for my examination by the Messrs. Shanly, and upon these I give the result of my examinations as above stated."

Q. Now, limiting yourself to item 3, what was there remaining to be done by the Shanlys different from that described by the contract?

A. There was, in the first place, the length to which the drain had been carried by the State. That is, there was a central drain or ditch, which was built to carry off the water, and also to hold the air-pipes for power and ventilation. That ditch was represented as being completely built, except the covering-stones, for a length of 5,017 feet, on the specifications that we used. But it proved afterwards that that ditch, instead of being 5,017 feet long, was 4,816 feet; that is, it was 201 feet shorter than was represented in the haste of making up the description.

Q. You agree with Mr. Shanly about that measurement?

A. I do; it is on my estimates in 1869, I think, or 1870.

Q. Was there anything else?

A. At a very late day it was discovered that the 4,816 feet of ditch which had been taken out by the State had not been made complete; that it was a partial and incomplete work, instead of being complete, as represented to me, and as I supposed. There was a considerable cost resulting from the further opening of that ditch to make it the proper size.

MR. TRAIN. I will call the attention of the Committee to that clause in the contract under which this work, as is claimed by the Commonwealth, should be done by the contractors:—

"4th. Excavation below floor of Tunnel, and construction of a central drain, as exhibited on the sectional drawing in engineer's office in North Adams, a copy of which is annexed hereto. Estimated length, 5,600 feet."

Q. That was the estimated length yet to be built,—5,600 feet?

A. Yes.

Q. Was that the length of the section, 5,600 feet?

A. That is the estimated length; the actual length built is 5,801 feet.

Q. The estimated length was 5,600 feet, and the actual length 5,801 feet?

A. Yes.

Q. Where is the provision about covering the drain, to which you have referred?

A. That does not appear in the contract; it appears afterwards in the list of prices. It appeared on the original estimate of the quantities that were necessary to complete the Tunnel.

Mr. TRAIN. Yes, it is at the bottom of the 7th page:—

“Temporary use of timber for covering central drain, as heretofore found convenient, will still be permitted, but permanent stone coverings must be provided and put in place, in advance of any allowance for track-laying.” Is that it?

A. That is it.

Q. Now, then, passing from that, I wish to call your attention to item 5. “Taking out loose rock after the Tunnel had been trimmed.” You claimed, in the settlement with Mr. Shanly before the governor and council, that that was covered by the contract. State the ground on which you base that opinion.

A. I would read simply the first half of the first paragraph on the first page of the “Memorandum of Agreement”: “The parties of the first part hereby covenant and agree with the said Commonwealth to do and perform all the work necessary to complete the Hoosac Tunnel, with its central shaft (being a portion of the Troy and Greenfield Railroad), in accordance with the schedule hereunto appended, and furnish all materials, and lay down and complete through the whole length of the Tunnel one railroad track, and after the completion of the Tunnel and railroad track, to remove from the Tunnel all materials and other things, so as to leave the Tunnel and railroad track in complete order, ready for use, and to the satisfaction of the governor and council of the Commonwealth.”

Q. (By the Committee.) Is there anything said in this contract about an allowance on this part of the Tunnel which was supposed to be completed at that time?

A. It appears in the quantities. It appears in the schedule, page 6, under the head of “Work required to be done,” where there is a description of each of the three sections of the Tunnel. In that general description you will find the only reference to it, apart from the estimate of quantities.

Q. (By Mr. TRAIN.) Well, then, if I understand it, you considered this part of the work, “removing loose rock,” as necessary to the safety of the Tunnel, and so coming within the provisions of the contract?

A. I did.

Q. In regard to item 2, whose fault do you think it was that this road was not laid at grade; that there was a higher grade than there should have been?

A. Why, the fault of the contractors’ superintendent, of course, excepting for that short distance that I did not know about, at the commencement of the length of embankment for the railroad. With regard to the remainder of the distance, they had abundant notice



and abundant fault-finding and complaint. It annoyed me to have the irregularity go on.

Q. (By the Committee.) If the State had had an engineer there, they would have got it at grade, wouldn't they?

A. We had an engineer at that part of the work.

Q. They didn't follow orders?

A. No.

Q. And that, right along, was a continual source of complaint?

A. Of worriment and complaint, and of promise, in many instances, on the part of those men that they would bring it down to grade. In some cases, the promise was made that they would bring it down next spring; they could not so cheaply level it down in the winter. I recollect, in one case, they said it was frozen, but the next spring they would get it all right. When I say that it was a matter of constant worriment and complaint, I would like to have it understood what I mean. If I had made very frequent complaint about everything that went wrong, we should have been in trouble all the time; but once a month I attended to the matter, and if they were above grade, I had a stake set, showing how much they were above grade.

Q. You calculated that they were to deposit this rock in making the road, instead of throwing it out as they pleased?

A. I calculated that they had to keep below the level of the stakes; that was the point. My order was that they must keep below. If they had kept a foot below, I would not have complained. I did, at a subsequent date, fill up parts of the bank, which were too low.

Q. (By Mr. TRAIN.) How much too high was that highway graded?

A. Six or eight feet; I can't state exactly, but that will be near enough. The filling for highway, at the highest point, as first dumped, was certainly six or eight feet higher at one point than was originally intended.

Q. Did that have to be removed?

A. Not all removed, because I found that I could arrange a road with good grade, having a surplus of material there, by changing somewhat; and I did finally change the grade, for the advantage of the contractor, and no injury to the highway, so that it made a little less quantity to take out than if I had insisted upon my original order.

[The witness here exhibited a diagram showing the east end of the Tunnel, the Deerfield River, the well that supplied the power by which the driving was done, and the embankments of the railroad and highway.]

Q. How much too high was that (the railroad bank) carried?

A. I think probably a couple of feet at the most. This filling followed the railroad from the bridge down to a point not far west from the depot grounds. [Referring to the diagram, and indicating successive parts.] We have always called this part of the filling the railroad embankment; and that other part is the filling which was necessary to make the highway. The latter filling was made at the face of the cliffs, so as to furnish an easy grade of descent from the level of the land, near the portal of the Tunnel, down to the low lands on the river; by which I mean the bottom lands on which the little village just below the Tunnel is built.

Q. Now, I have only one more question in relation to this. Suppose Mr. Shanly is to be allowed for doing this work on the embankment, has he charged a fair price for it?

A. Yes, sir; I say it is a fair price, because that is what it cost. They prosecuted some of it in bad weather, which made it more expensive than it otherwise would have been.

Q. Now I will go back to item 5. This removal of loose rock is not confined to places where arching is required?

A. Not at all; the fact of it was, we somewhat modified our demands for careful trimming over the places where we contemplated arching; that is, we didn't require it to be as carefully trimmed, because, in fact, it would have been useless. The only thing we calculated to do was to get it fit for trains to run on.

Q. Can you tell us whether, supposing an allowance was to be made, that charge of \$22,246 is substantially correct or not?

A. My own estimates show a very trifling difference. Yes, sir, it is substantially correct.

Q. Now, Mr. Frost, passing from this, I come to item 6, which is for clearing out the Farren arch, which was filled by the storm of October, 1869; have you a diagram which will show the Committee the location of the Haupt Tunnel and the Farren arch, and how they were affected by the storm?

A. [Exhibiting diagram.] This is what we call a section; that is to say, the representation of a vertical plane passing through that part of the work. This shows both the Farren arch and the Haupt Tunnel. The latter was made in the hill, through which we decided eventually to make an open cut of approach to the main Tunnel. Mr. Haupt, in his anxiety to commence tunnelling as soon as possible, made a tunnel through it. His short Tunnel—a little more than 500 feet long—was made when the State took possession of the work. That [pointing to part of the diagram] represents the 931 feet distance of brick arch built by B. N. Farren, under an early contract, which was finished just before the Shanlys went to

work. The contract with the Messrs. Shanly, as was evidently necessary for any profitable working of this west-end section, provided that this Haupt Tunnel should be kept open. It was the only means of exit at that end, either for flow of water or for material coming out of the Tunnel. That was the condition of things when the Messrs. Shanly took the work. This was the expected condition of affairs which they found. In the second diagram, I have undertaken to make a plan, showing a certain part of the Tunnel near the west portal, and part of the adjacent length of the railroad. [Pointing successively at different portions.] Here is the little Haupt Tunnel; here is that part of the railroad cutting which now extends over the length of that part of the Haupt Tunnel which has been broken down and taken away. There [pointing] is the length of the Farren arch, and there [pointing] is the position of the brook (something like 200 feet off at one point, as I recollect) which carries the water of that stream,—the Tunnel brook, from which the so-called flood of October, 1869, occurred. In that flood of 1869, the brook burst out of the channel that had been made for it. That [pointing] shows the original brook, and that the diversion. The diversion was made a long time ago, in order to keep the water away from the opening of the Tunnel; but at the above-mentioned time, the water broke out, following the course shown by the dotted line, and swept right alongside of the Farren arch. It carried away all the earth from the top of the arch, on the north side, so that you could see the brick-work, where it had been previously filled over it, to a depth of over twenty feet. It brought the material down to the place which I now indicate by my pencil, so that it filled up the Haupt Tunnel. When that was filled, then it had to flow eastward, and the current went with such speed and force as to carry large quantities of mud, by the deposits of which the Tunnel was at last absolutely filled up against the very top of the arch.

Q. How far did this mud, stone and stuff run in?

A. It went in for 200 or 300 feet in large quantities; but the greater part was deposited within the length of the first 100 feet. A certain quantity of the mud was carried in more than a thousand feet distance.

Q. (By Mr. ALLEN.) Didn't it flow up beyond the west shaft?

A. Why, yes; it drowned or drove out all persons occupying the length for which the Tunnel was open from the west end.

Q. How far was that?

A. It was about three-quarters of a mile.

Q. It drowned some of the men, didn't it?

A. It drowned one man, and one other man but just accom-

plished his escape. It must be deemed a merciful escape for the force that more were not drowned.

Q. That brook broke the embankment which you had made?

A. It was a regular canal, which had been made on the side of the hill. This is a steep side-hill shown by the lines I indicate. I think that at this point the grade of the canal was about 60 feet above the grade of the railroad.

Q. Who made the canal?

A. It was made by the State, under Mr. Doane's direction, the first engineer.

Q. When?

A. Probably in 1863 or 1864.

Q. And kept in repair by the State?

A. Yes, sir, until the whole thing was turned over to the Shanlys.

Q. (By the Committee.) This looks much as if this channel is narrower than the river?

A. The channel was undoubtedly wide enough. It is, as many canals are made, narrower than the natural bed of the stream.

Q. (By Mr. TRAIN.) Now, we understand the claim to be for clearing out the Farren arch of the debris which had been driven in by that flood?

A. Yes, sir.

Q. That you claim this work to have been within the provisions of the contract, and that the contractors were bound to do it themselves?

A. That matter was fully considered by the committee of the council, to whom I referred it, and, therefore, I acted under instructions.

Q. The contractors could not use the Farren arch for their own purposes without clearing it out, could they?

A. No.

Q. Nor could they use the Haupt Tunnel without clearing it out after that storm?

A. No.

Q. They did them both?

A. They did both. I make an exception at a later date. I am confining myself now to this year, 1869.

Mr. TRAIN. That disposes of all the legal items, I believe, except one, which I shall group with one of these claims which are called equitable claims. I pass now to item 7, "for errors in original measurement of Tunnel rock." I wish to call the attention of the Committee to the last provision of the contract, which I shall claim by-and-by to be applicable to this item:—



“It is understood and agreed that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule, nor shall the specific details of work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part now under contract to B. N. Farren, to be performed under this contract, nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract.

I will first ask you, Mr. Frost, whether there were any errors in the original measurements of the Tunnel rock, and if so, state what they were.

A. It was perfectly impossible, as a whole, to say what quantities were going to occur in a Tunnel of which we had not yet defined the dimensions to be executed, as regards the arching,—that is, for the length of the arch to be built. The difference, you know, is considerable. There is required only about 16 yards of excavation to the running foot of Tunnel where there is no arching, but the quantity is increased up to 22 and 23 yards, or more, per running foot where arching is required. I could expect, therefore, to afford in advance only an approximate estimate as to the quantities which would be required to be done. It was not then possible to foretell the precise amounts. There is another point which should be noticed, and that is this: In making up an estimate, in which so large a proportion of the whole was conjectural, I did not enter into a very minute calculation of the details, burdened as I was with more important duties. I made a general test of quantities, out of which I concluded that the previous computations made in my office represented as fair estimate as could be made of the total quantity that would result in the building of the Tunnel. The tests above described were the only tests which I applied to the minute calculations of my assistant. Now, it would seem that he may have misapprehended the exact positions of some of the various lines which must be drawn to make up the perimeter of the Tunnel where built in rock. My assistant, in 1868, in computing the quantities now in question, seems to have made very nearly the same mistake which Mr. Shanly has made again this year, and, in consequence of which, he has once withdrawn his charge for this account, which he has subsequently brought back again. In point of fact, there was an error amounting to two-thirds of one per cent. in the statement of the area of the diagram which was to be used, so that I have required the Shanlys to make a Tunnel larger than the diagram represented to them by that amount; making, instead of the 250,310 yards which they expected to exca-

vate between certain points, 252,000 yards which they actually did take out.

Q. Making a difference of how much?

A. I would like the privilege of supplying the exact figures hereafter, but, in general terms, that is the statement regarding that diagram, and that diagram is represented in one of the three which I have produced before the Committee. This explanation applies only to that portion of the length of the Tunnel which had not then been opened. As regards the lengths of Tunnel which had been already opened, including that length at the western end where the greatest uncertainty existed as to the quantities which would be requisite, it should be stated that my estimate was too liberal, giving more than the final result; so that the total aggregate amount, instead of being more, is actually less than the quantity stated by my estimate in December, 1868.

Q. I want you to give the quantities.

A. I have them tabulated, and will furnish the figures in a few moments; the paper seems to have slipped out of sight, and I do not find it at this moment.

Q. The result of it is this, that, calculating the amount of work by the items in the specifications, there is an error claimed by Mr. Shanly?

A. There is.

Q. But he did not actually excavate the amount which these items in the specifications called for, in the aggregate, by an amount which you will give us by-and-by, when you find your diagram?

A. Yes, sir.

Q. Will that statement, when we get it, show the amount in dollars which he gained by the difference?

A. It will show the amount in dollars if we take the contract prices as ruling the computation. I have before me now the one quantity which I just before sought to give you; that is, the increase which resulted from that error in the diagram. Mr. Shanly has been obliged to proceed heretofore from statements of approximate estimates, because the quantities of final computation have not been sent to him. The final computation makes the difference 1,914 yards. I now offer for your inspection a diagram which shows the Tunnel, so far as opened in the spring of 1869, when Mr. Shanly commenced operations. The shaded parts represent the work that had been done by the State, and there is placed on that, item by item, the very quantities which I desired to give you a few minutes since. On the left is shown the little hill through which Mr. Haupt made his Tunnel. Next, to the right, is shown the length of arch,

931 feet, which was built by B. N. Farren, and still extending to the right is shown the amount of further work which had been done by the State in the western half of the mountain at the time Mr. Shanly commenced his operations. The original design of working was to make the heading of the Tunnel at the bottom; but in that west-end section, after they had penetrated to a certain distance, it was recommended by Mr. Latrobe that they should commence driving at the top. The diagram shows that they drove the heading for a certain distance along the floor of the Tunnel, and then afterward worked up against the roof for the remaining distance of advance made. I can now proceed to the mention which you asked for of my schedule made to exhibit to the contractors the descriptions and quantities of work which they would have to do. I made a statement, commencing at the east end and thence proceeding in order westward, showing the distances where the Tunnel was supposed to be full size, where it was partially completed, and where the entire work remained yet to be done. The several descriptions of work are classified in the contract made with Mr. Shanly; the quantity of each description of work is stated and computed at its proper contract price.

Q. Was that central shaft sunk?

A. It was down 583 feet of its 1,028. They went down 445 feet under their contract.

Q. Did they leave anything in here (in the Tunnel)?

A. They commenced their workings in the same way as I before described to you, concerning the last state work in the west end. They worked first on top, and then took out the bottom of the Tunnel afterwards. The quantities originally estimated under the Shanly contract were as follows:—To enlarge the gallery 4,058 feet long in the west end, which the state forces had opened, 52,800 cubic yards. To build the Tunnel through the length which had not yet been opened (work called Tunnel extension), 250,310 cubic yards. To enlarge the gallery 5,283 feet long, which the state forces had opened from the east end, 32,500 cubic yards. The quantities that were actually moved, under the Shanly contract, by the final estimate, were as follows:—In the west end, to finish the length which the state forces opened, 48,685 cubic yards. To build the Tunnel through the length which the Shanlys first opened (work called Tunnel extension), 252,224 cubic yards. To finish the length which the state forces opened, in the east end, 32,431 cubic yards. Taking into view the time necessary to sink the central shaft, and consequent delay before they could commence working east and west from the central shaft in the Tunnel beneath, it was computed that out of the 250,310 yards of Tunnel extension estimated, 82,940 yards would be hauled out through the west end, 82,270 yards



would be hauled out through the central shaft, and that 85,100 yards would be hauled out through the east end. I have marked on the diagram the lines of conjectural division which were established in order to make up the scheme of operations by which the quantities of work, called Tunnel extension, were assigned in the schedule. The quantities to be excavated from the distances marked out each side of the central shaft, were expected to be lifted out through the shaft, and were designated as workings of the "central section," and those which it was expected to haul out from the west end were included as part of the workings in the "west-end section." That is the way in which the classification, shown by the contract, was arrived at. [See table, p. 102.]

Q. (By Mr. TRAIN.) That is to say, if he made his monthly progress from west to east, and from east to west, the headings would meet about at the point you indicate?

A. Yes, sir; that is it, exactly. The ultimate result is, that Mr. Shanly, in this one item of excavating rock, classified in the schedule as "Tunnel extension," has actually moved 1,914 more yards than he expected to.

Q. And how much less at the other end?

A. On the west side, the contract required—that is, the quantities that were stated to him would require—his removal of 52,800 yards, and he did actually remove 48,685 yards; in round numbers, upwards of 4,000 yards less. In addition to this, however, he removed a quantity of loose rock—2,731 yards—which had been blasted out, but left in the Tunnel by the state forces. That was not mentioned in the contract at all. The cost of this would be about one-eighth that of solid rock,—that is, the cost of removing the 2,731 yards would be about equivalent to that of removing 340 yards of solid rock.

Q. How much less did he remove in the part that had been opened?

A. Four thousand one hundred and eighty-four yards of solid rock.

Q. Less than the specifications provided for his removing?

A. Well, the specifications were silent on the subject, but less than my estimate, which, of course, he had.

Q. And out of that should be taken 340 yards overplus of rock?

A. Yes; the 2,731 yards of loose rock divided by eight. That is about as fair a way as I know of of stating it. It is worth about one-eighth as much.

Q. (By the Committee.) Where did Mr. Shanly get his figures to make his estimates, originally?

A. From nothing else than my estimates; he couldn't.



Q. He didn't have time to make measurements?

A. O no, sir.

Q. Why was this clause on the last page put in, if he had not made any measurements?

A. Well, I said, in general terms, that I knew that the quantities covered contingencies as we saw them then, and it has been proven by the facts, that the total quantities were sufficient to complete the work of the contract.

Q. (By Mr. TRAIN.) If it measured any less, he was not to allow the Commonwealth anything; and if it measured any more, the Commonwealth was not going to pay him?

A. That was the legal effect of this clause.

Q. (By Mr. ALLEN.) You say that was the legal effect of it?

A. Excuse me; I spoke of my own view, without thinking to declare the law in the matter.

Mr. TRAIN. I suppose that all that Mr. Frost meant was, that that was his understanding, at the time the contract was made.

WITNESS. When I speak of the "legal effect" of any clause, I speak of the interpretation which I should feel obliged to put upon it until advised to put another.

Q. (By the Committee.) Then I understand your testimony to be to this effect: that instead of Mr. Shanly having a claim for overwork, the State really has a claim for underwork, on that basis?

A. Well, that is a matter to be considered; I have stated the facts here, and I shall not give any more law, after the rebuke I got.

Mr. ALLEN. We were thanking you; we were not rebuking you.

Q. (By Mr. TRAIN.) They didn't take out as much rock as the estimate called for?

A. That is the fact.

Q. At any time, did the contractors perform their work according to the stipulations of the contract; I mean as to the quantities to be excavated per month in the different sections of the Tunnel?

A. No; they never accomplished all which the scheme of progress demanded; but in certain months they did more than the *rate* of advance which was specified.

Q. In all the sections?

A. I think it probable; I never looked to that at all. My care was to keep account from the commencement, and to see whether they reached the standard of total progress. At the commencement of the work a standard of progress was fixed for the whole of it, which they were to follow, as far as possible, until a new one should be established. I have not any doubt that in some months they did more than the rate required. The standard of progress was an in-

creasing one. If they left a thousand yards one month, that was added to what they were required to do the next month ; so that, on the whole, they never came up to the full standard. This is evident from the fact that they did not finish the Tunnel in time. If they had, they would have finished the Tunnel within the limit of the time of their contract.

Q. They never came up to the average required?

A. I say that this is the fact, if you take the requirement as I was obliged to compute it, as if expecting the completion of the Tunnel within the contract time ; but if you take the average rate which I estimated at the commencement of the contract work in 1869, there were months when they did more than that. In 1869, they had before them five years,—that is to say, sixty months, in which to do the work. The standard requirement, then, for each month, was one-sixtieth of the whole work. At that time, roughly speaking, they would have attained the standard by doing one-sixtieth of the whole work in that one month. The first month they actually did nothing ; there then remained only fifty-nine months. Then their standard for each month became one-fifty-ninth of the whole work. If they had done nothing for six months, their standard would have become one-fifty-fourth of the whole work. Thus, as I say, if you take the original standard of one-sixtieth of the whole work per month, there were a good many months when they must have come up to or exceeded that standard.

Q. But, counting from the commencement, they were always behind?

A. Yes, sir ; on the whole.

Q. (By the Committee.) How did he get it done in time, if he was always behind?

A. He did not ; the contract was that the work should be done on the 1st of March, 1874.

Q. (By Mr. TRAIN.) Now, take the central section ; the contract has this provision in relation to that section :—

“ They shall employ suitable force, and shall maintain, after June 1, 1870, an average rate of monthly progress of Tunnel excavated to full size, east and west, of not less than 80 feet in each direction.”

Did they ever comply with that provision?

A. They never attained to it.

Q. After the completion of the central shaft, Mr. Shanly tells us they were obstructed by water. I want to bring you now to the subject of the water, and the notice which you gave the contractors, under the contract, in relation to it ; what they did, and might have done more ; and whether they could have carried out that provision

of the contract which requires them to make that 80 feet advance in those headings per month.

A. The workings of the Tunnel in February, 1871, westward from the central shaft, and continued also into a small part of March, developed a very considerable quantity of water, and indicated that they were getting into water-bearing veins in going west. Mr. Shanly then undertook the putting in of one large pump, which was discovered at a later day not to be sufficient to carry out all the water. When this first became evident, there ensued much discussion about the matter, until March 2, 1872, when the matter assumed a definite form, by my instructions. What he had hitherto done was deemed not sufficient.

Q. Did you give the Shanlys any instructions in March, 1872?

A. I was going to read the instructions I did give them.

Q. Before that, did you receive a letter from Mr. Philbrick on the subject?

A. I did. I had informed him that there was a stoppage of work there, and that it created a contingency which ought to be considered.

Q. (By Mr. ALLEN.) Was that letter given to Mr. Shanly?

A. It was not given to Mr. Shanly.

Mr. TRAIN. If they object, I will not read it. Here is the letter of instructions from Mr. Frost:—

ENGINEER'S OFFICE, HOOSAC TUNNEL,  
NORTH ADAMS, MASS., Saturday Evening, March 2, 1872. }

MESSRS. F. SHANLY & Co.:—I have to notify you of the conclusion of the executive council that you must be required to resume at once the progress at the heading westward from the central shaft, and also continue to follow up with progress of enlargement, as now doing, in accordance with the provisions of your contract.

It is appropriate, in this connection, that I should communicate to you the opinion of the engineers, that your present pumping apparatus, if reinforced and increased only by the comparatively small amount which you are understood to contemplate, will shortly prove inadequate for the removal of the expected flow of water, and that your preparations ought forthwith to be commenced upon a scale more nearly commensurate with the probable emergency. Yours respectfully,

(Signed)

BENJ. D. FROST.

Q. Was that instruction given in consequence of the letter of Mr. Philbrick?

A. Undoubtedly. This letter is dated February 28.

Q. Won't you read it?

Mr. ALLEN. I would like simply to have it understood, that I do not think it is a fair way to affect Mr. Shanly to produce docu-

ments of that sort, which have not been communicated to him, and produce them here, when we get knowledge of them for the first time. I do not like to raise any technical objection, but I do not think that it is fair.

Mr. TRAIN. I do not know why it is not fair.

The letter of Mr. Philbrick was read as follows :—

FEBRUARY 28, 1872.

BENJAMIN D. FROST, Esq.

DEAR SIR:—I have just had an interview with the governor and council, and explained to them the present condition of the work at the central shaft. They are unanimous in the opinion that the contractors should be required to resume work on the western heading at once, and prosecute that point, as well as the enlargements both ways, as required by their contract. Please lose no time in serving notice on them to this effect. In case they argue the probable trouble from new influx of water, it may be well to mention that their present pumping apparatus is, in our opinion, quite inadequate to meet the probable flow, and that the proposed change of the small pump for one of even twice its capacity would also soon prove inadequate. So it seems that prudence requires additional steam-power, and this should be provided at once. In regard to the matter of trimming, also, no good reason appears for its delay at the east end, and a force should be applied there at once for that end, and kept there.

Very truly yours,

EDW. S. PHILBRICK, *Consulting Engineer.*

Q. Thereupon you sent this notice of March 2?

A. Yes.

Q. How much water were they getting at that time?

A. Probably about 200 gallons a minute. That is from recollection; I have not the figures.

Q. (By the Committee.) Had the governor and council, any or all of them, been out there to see that water?

A. No, sir; the communications with the governor and council would perhaps be more properly stated by the consulting engineer, who was here. As I have already stated, the matter was made a subject of direct communication to him, and he conferred with the governor and council, and wrote me what they had concluded. It was an easy way of getting at it; I was busy on the ground.

Q. Have you any diagram of the size of the central shaft?

A. I have the figures in my mind; it was 27 feet long by 15 feet wide, made in an elliptical form, of which the two diameters were 27 and 15 feet.

Q. How much space was taken up by the pumps?

A. Well, substantially, a pump of almost any dimensions could



be planted in each end, and even further provision than this would have been possible. The original designs in regard to the shaft, as I understood, contemplated that one large-sized pump might be planted in each end.

Q. When did they begin to work east?

A. They began working there in 1870. It is concerning the progress west that all this conflict arose. They commenced working east in October, 1870, first.

Q. When did they begin to work west?

A. They commenced working west at the same time, and they continued to work west until this emergency arose, when they proposed to stop.

Q. In March, 1872?

A. February, 1872.

Q. Mr. Shanly has stated that they completed their pumping machinery in October, 1871, and resumed work in the east heading, but the indications of more water were so apparent on the western face that they deemed it imprudent to break further into that rock on that side.

A. I will ask permission to amend my statement in regard to the 200 gallons a minute, at that time. I must say that I don't recollect the exact quantity, but it was not so much as 200 gallons a minute. I should prefer to have that stricken out, for the reason that I was misled by my too hurried inspection of the diagram.

Q. Now, when could they have provided sufficient pumping power to have avoided this delay, and when should they have done so?

A. If it were insisted, they should have commenced during the six months preceding.

Q. Preceding what?

A. Preceding the time when these notices were given. If it was insisted they might have gone on, but the time when the necessity became most imminent was then.

Q. When?

A. At the time when these notices were given.

Q. March 2, 1872, is that the date you mean?

A. I said so; but the trouble in regard to undertaking to say what we should or should not have done at that late day in regard to this work, consists in the fact that it should have been begun a year beforehand.

Q. (By Mr. TRAIN.) I want to know when they should have begun putting in pumps; in March, 1871, there were 80 gallons a minute flowing.

A. I know it; and there was evidence of an increase of water;

if I had been working it for the State, I certainly should have commenced then ; it is unnecessary to say that.

Q. (By the Committee.) What was the capacity of the pump at that time?

A. At that time, January, 1871, they were engaged in putting in their pump of 140 gallons' capacity.

Q. (By Mr. TRAIN.) They did not get that pump in until the next October, did they?

A. No ; but they were making preparations for it.

Q. You refer to the same machinery which Mr. Shanly refers to in his memorandum, when he says that the pumping machinery was completed in October, 1871, and work resumed in the east heading?

A. Well, I think that would have been the more appropriate time. Am I understood to have made any answer about the time when Mr. Shanly should have gone to work in putting in a second pump?

Mr. ALLEN. I thought that you had been trying to answer that for the last ten minutes.

Q. You have already said, that if you had been at work for the State you should have put in those pumps in March, 1871, when he began to put his pumping machinery in, and got it in in October following. Now I want to know if he could not then have put in all the pumping machinery that was necessary to have kept that shaft free, and enabled him to comply with the provisions of the contract to drive 80 feet in those two headings per month. Do you understand me?

A. Yes, sir. That is a matter of recollection which concerns matters as to which you already perceive it is difficult to review carefully. I should say, in general terms, that the completion of his large pump would have been the time. The proper way is to rest it just where I did at first, and that is, that experience shows the time when the emergency had fully developed itself. As to precautions, those are simply matters of opinion, as to which I should have to refresh my memory by going over my memoranda.

Q. Very good. Then you mean to say that in February, 1872, when you gave those notices, he was bound to have furnished sufficient force?

A. Yes, sir.

Q. And that might have been done? That is to say, there was room enough in the shaft for all the pumping machinery that was necessary to keep that free, so that the work could have been done?

A. Yes, sir ; my letter will be noted as referring distinctly to that point.

Q. (By the Committee.) I understand the letter to you to have

been to this effect: that the governor and council considered that he had not made proper provision for pumping, and that if he had made proper provision for pumping from the very first he might have continued, at any rate, until that time, and there would have been no trouble?

A. That is just where the difficulty of my reply comes in. All provision for an expected flow of water is necessarily anticipatory. The emergency had then become so evident, that we felt no hesitation in declaring that it was evident. The apprehension might have come at an earlier day. We were coming into water, and we might have felt that it would be wise to make provision for additional pumping machinery. But that is where the difficulty always comes in in dealing under a contract. That is to say, that we are requiring the contractor to make provision for a possibly conjectural danger. It may be that, up to a certain time, we go through ground where we are getting a continual increase in the quantity of water, and it is reasonable to argue that in the succeeding progress through another thousand feet there will be a corresponding increase. It is to be remembered, however, that we are also liable to enter into rock which is not water-bearing. The contractor might go on and make these provisions for pumping, under our orders, and the result might prove them useless. From this you will perceive the difficulty which I have found in making my answer, the more especially that it was an answer based upon recollection only of the conditions and indications appearing during the period which is referred to.

Q. (By Mr. TRAIN.) I want to get at your judgment in relation to it. You have already said that if you had been doing this work as the agent of the State, you would have supplied more pumping-power. What should you have done yourself, with your knowledge of the facts, if you had been the agent of the State, in regard to putting in more pumping-power? Should you have put in more pumps or less pumps, or none at all?

A. I see you have stated one thing—

Mr. ALLEN. Can't you answer the question?

A. Mr. Train has stated something which I asked to amend in my testimony. I said I had been misled by those diagrams in regard to the time when I should have commenced putting in those pumps, and I asked to strike that out, for the reason, that it was dependent upon recollection, and I had been misled by the too hasty inspection of the memorandum upon which I depended to establish my recollection of these things. Now, I will answer directly the question, if you will ask it again.

Q. When would you have put in more pumping-power, if you had been doing that work?

A. I should have commenced at the time those notices were given, at least, and probably sooner.

Q. And what pumping-power should you have put in? Would you have put in one pump, or would you have put in more? How many pumps would you have put in, and of what capacity?

A. I was not satisfied with that one pump, because it was not sufficient to make progress; and as to the size of the pump I should have put in, I should have necessarily to refer to the data of quantities and increase to make a proper answer. I stated definitely that the pumps they were providing were not deemed sufficient.

Q. And they proved insufficient?

A. They proved insufficient.

Q. And the consequence was, that they never performed that part of the contract requiring them to work east and west at the rate of 80 feet per month?

A. That is it, exactly.

Q. Now, if that had been done, I want to know if the contractors would have been able to have completed their contract within the time limited?

A. No, sir.

Q. Well, if they had carried their headings east and west at the rate of 80 feet a month, would they have got through in the five years?

A. I have misunderstood; if they had done that, they would.

Q. And in answering that question, do you allow for the delay which would have been requisite to give them time to put in the requisite pumping-power, after the notice of February, 1872?

A. No, sir; that is, the time had already passed in which they could hope to complete their work in proper season.

Q. Well, how much time would it have taken to have put in an additional pump of the size of the one they did put in? Supposing, instead of putting in one, they had put in two, how long would it have taken them? How much delay would it have occasioned?

A. That would be a very difficult question to answer.

Q. It took them six months to put in one, would it have taken six months to put in another?

A. I should say four or five months.

Q. Would it have caused any additional delay, if two pumps had been put in at the same time, instead of one?

A. A part of the work could have been done in connection with the work of putting in the other pump.

Q. Suppose that in February, when you gave that notice, in-



stead of starting off and putting in one pump, they had started off and put in two, when would they have got the two in, so that they could work?

A. They had at that time one pump in.

Mr. TRAIN. I know that, but they put in another.

Q. (By the Committee.) What sized pump did they have in at that time?

A. They had their 11-inch pump in at that time. I felt that the opinion of the council was that there should be a second large pump put in, and instead of that they were going on to put in a small one.

Q. Did you say how large a pump you thought was necessary?

A. I said I couldn't at this moment recall what I should have decided. I only recollect, in general terms, that I felt that in order to make their required progress they must put in a pump of very large capacity.

Q. Did you have in mind any size?

A. No, sir, because Mr. Shanly never proceeded to an interchange of views that would have led to my giving any directions about it. There was no consideration of the matter, except in general terms. The indications then showed the necessity of a very large increase of pumping capacity, and that the comparatively small pump which he was understood to intend to put in, and which he did proceed to put in, as an aid to his one large pump, was entirely insufficient for the purpose.

Q. (By Mr. TRAIN.) You had no authority to specify the size of pump?

A. That is what I mean, exactly. I will say, in general terms, that I am quite sure that at that time, if the question of size had come up for decision, I should have said that the second pump should have been as large, or larger, than his large pump already in.

Q. Well, if he had put in a pump as large or larger than his large pump, would he have had pumping-power enough to have kept that shaft free, as the event showed?

A. He would, until very near the time of meeting. In point of fact, with a second pump as large as the one he put in, he would have been able to keep the shaft free, with the same device of sometimes devoting his hoisting machinery to the work of baling.

Q. (By the Committee.) If he had put in another pump of the same size as his large one, you think he would have been able to have gone on with the work until the west heading had been finished?

A. I think he would.

Q. If you had been at work as the agent of the State then, would you have gone on and put in another large pump at that time?

A. Undoubtedly. That was the requirement,—that the work should go forward.

Q. Do I understand you to say that another large pump would have been sufficient?

A. I mean to say that there would have been no stoppage after a second pump of that size had been put in.

Q. You say that from your knowledge now ; but could you have said so at that time?

A. No ; that is just where the difficulty comes in to which I have referred. If the question had been referred to me for decision, I might have said a larger pump than that one was the proper one demanded ; but in his declining to consider the notice, the responsibility of saying just what size should be prescribed did not come upon me.

Q. In your judgment, did Mr. Shanly, in the first place, take the proper and ordinary precautions, with regard to water, that he should ; that is, did he put in a pump of the proper size which good judgment and a knowledge of the business would require a man to put in, if it is a fact, as you say, that it was impossible to know just what might be wanted until things developed, and as they developed, indicated that more pumping-power would be required?

A. Yes.

Q. In the first place?

A. His procedures in the first place seemed to be very appropriate. I did not find occasion to take direct issue with him until this late date.

Q. (By Mr. ALLEN.) March 2, 1872?

A. That is it.

Q. (By the Committee.) That is when the water was coming in at the rate of about 80 gallons a minute?

A. I did not find occasion, may it be understood, to touch distinctly the question of pumps ; but he was not moving adequately in the matter. If he had been fully convinced of the necessity of going forward, he would have commenced earlier to make the provision. That is the difficulty that I stated in making an answer from recollection as to a matter that at the best would be a matter of judgment.

Q. (By Mr. TRAIN.) What was the maximum amount of water developed there?

A. I have to speak without my notes, but I am quite sure that 200 gallons a minute was the largest flow.

Q. Then, of course, that was all the flow that needed to have been provided for?

A. That was the maximum quantity.

Q. (By the Committee.) That means before the headings met?

A. No, sir; that was the largest amount.

MR. ALLEN. Mr. Frost will correct that statement when he comes to refer to the documents.

WITNESS. I will ask it to be understood, that when I speak of the largest amount of water, I mean always the largest amount flowing at any one time. We often struck springs or struck caverns of water there which would run for a few days, and then exhaust themselves.

Q. Very large springs?

A. Certainly.

Q. How many gallons a minute?

A. We considered those the accidental and occasional things.

Q. Well, how many gallons a minute?

A. I never took the trouble to compute, because it wasn't possible.

Q. Should you say a thousand gallons a minute?

A. Well, hardly that; when you tap a cavern of water, it runs immensely, until it has emptied itself. If you knock in the head of a hogshead, the water runs out in an instant.

Q. Did you find those caverns that would yield, in your judgment, a thousand gallons a minute for a few days?

A. O, no, sir.

Q. How much?

A. Well, we never found variations running over twenty-four hours of any great increase. I think the proper way is to let me look at my record, and I will tell you in a minute.

Q. (By Mr. TRAIN.) Will you look at any record you want to, and then answer Mr. Allen's question?

A. I should say this, that I have but very partial and incomplete records here; so much so, that it would be hardly worth while to refer to them. There were no such enormous quantities struck as have been described—no thousand gallons. When I speak of large quantities of water flowing, I mean for a few hours.

Q. (By Mr. ALLEN.) You said they would run immensely for a few days?

A. I did not mean to say that. I must take that back, if I said so. I said there would be variations for a very few days. I said, as I remember now, and I think the Committee, also, will remember, that every few days we would strike little caverns, that, for a short time—a few hours—would run very largely; but they would very shortly run out. These spaces which we tapped were little caverns, or open seams in the rock of the mountain.

Q. (By the Committee.) Fed by the same springs that fed the other supply of water?

A. Yes, sir; except that these open places in the rock, being fed only by a very slight thread of water flowing from the surface, would, in a little time after we struck them, empty themselves. They would hardly have any material effect on the flow in twenty-four hours. We found the variations only about twenty or thirty gallons in the twenty-four hours, observed at different times.

Q. What did you mean by an immense flow?

A. I mean to say, for an hour, when we first tapped the cavern. I used the illustration of knocking the head out of a hog's head, which is a fair one. They would tap with one drill-hole into a water-bearing seam which had been filled up, and out of that two-inch hole would come a stream which would be thrown several feet, and run for an hour, or two hours, and then lose its force. In addition to the total quantity, it would make a great show, but would not add very largely to the average flow. After a day or two, it would be exhausted entirely.

Q. (By Mr. TRAIN.) Do you know just the quantity per minute that they ever pumped out of the central shaft?

A. I think it was just 320 gallons; but that was not pumped up from the central shaft.

Q. It was pumped over the bench?

A. Yes; in regard to the lift up the shaft, it was something like 200 gallons.

Q. Had you a pump at the west shaft?

A. Yes, sir.

Q. Did you pump more or less than they ever pumped at the central shaft?

A. More; the greatest amount ever pumped out of the west shaft was before my connection with the work; just previous to it; and that the record shows to have been 1,000 gallons a minute.

Q. (By the Committee.) Does it take a larger pipe or merely a heavier force to pump up 1,000 feet than it does to pump up 14 feet? It does not require any bigger pipe, does it, but more power?

A. That is it; the amount of power required is just in proportion to the height you have to lift it.

Q. You said the size of the central shaft was 27 by 15 feet, what was the size of the western?

A. I think it is 12 by 14, I cannot tell exactly, but it is much smaller than the central shaft. That was sunk before my connection with the work, and filled up with timber in such a way that I have not had occasion to deal with its dimensions.



Q. It was less than half the size of the central shaft?

A. Yes, sir.

Q. What was the difference in the pumping capacity of the pumps in the two shafts?

A. A large proportion of the water lifted out of the west-shaft working was taken out of a supplemental shaft built in connection with the west shaft; consequently the point you have in view cannot be argued; that is, cannot be reached for comparison.

Q. Just explain the difference; I don't want to argue the point; I want to get the fact.

A. The fact is, that the chief portion of this 1,000 gallons went out of the supplemental shaft adjoining.

Q. Do you mean it was pumped out into a well?

A. No, sir; I mean to say that another shaft was sunk right alongside of the western shaft, and near by it.

Q. How big was that?

A. I have not in mind the exact dimensions.

Q. Was it larger or smaller than the western shaft itself?

A. Somewhere about the same size.

Q. (By the Committee.) Was the size of the pipe about the same that had a capacity of 1,000 gallons a minute?

A. The two schemes of arrangement were made up in an entirely different fashion; that is to say, the pumping at the west shaft was done through an accumulation of different-sized pipes. There was one 10-inch, one 8-inch and one 6-inch used for the pumps there, so that there could be no analogy as to the room required.

Q. How about their power?

A. The pumps used at the west shaft were mainly self-acting pumps; that is, each pump had its own steam-cylinder attached to it. The letter I read covers that point, and that is, that they would have to provide additional steam-power in order to put in larger pumps at the central shaft.

Q. Did it require, not only larger pumping apparatus, but larger pipes? You mean the whole thing, do you, pipe and all?

A. Yes, sir.

Q. But still it seems that they had a larger pipe than you had at the west end?

A. We had a grouping of several pipes at the west-end shaft workings.

Q. I did not get that idea; then you had one pipe that ran down to the well that was 10-inch, and one that was 8-inch, and one that was 6-inch?

A. Exactly; yes, sir.

Q. Do we understand that there was plenty of room to put in more pipes at the central shaft?

A. I have in the letter touched that point; that is, that when the emergency occurred, this small pump, which was made to occupy one end of the shaft, should have been replaced by a much larger one. The requirements addressed to him substantially covered the putting of a large pump in the other end of the shaft, where there was equal room as in the end occupied by the large pump put in.

Q. Then there would have been no difficulty in putting in a larger pump on account of room?

A. No; the question of time and cost was the question.

Q. (By the CHAIRMAN.) The first pump was 11 inches and the next one five in the central shaft?

A. It was originally so; and Mr. Shanly's enlargement only carried it up to an 8-inch pump.

Q. (By Mr. ALLEN.) Then there was a pump of 11 inches and one of eight inches, was that so?

A. That is it; yes, sir.

Q. (By the Committee.) There was one of 11 inches in, and Mr. Shanly put in another one of eight inches, or changed the old one?

A. He changed the smaller one to an 8-inch.

Q. (By the CHAIRMAN.) The smaller one was a 5-inch pump?

A. It was a 5-inch pump before.

Q. Would two 11-inch pumps have carried the water?

A. That is the point; I said that they would have carried the water up to the time of meeting; that is, they would have made continual working possible with the aid, perhaps, for a short time, of the same device he used of turning the hoisting machinery in for occasional use in pumping.

Q. (By the Committee.) If he had been compelled to turn in his hoisting machinery, how could he have got out the broken rock?

A. I meant only the exceptional use of the hoisting machinery. He did for some time use the hoisting machinery for baling water. If he had put in two such pumps of the capacity I describe, it would have covered everything; but occasionally, for a day or two at a time, or for a short time, he would perhaps have been obliged to use the device he did use of turning his hoisting machinery to baling the water.

Q. (By the Committee.) You say that if they had put in another 11-inch pump they could then have hoisted out all the water? I do not understand you to mean by that, in addition to the 8-inch and 11-inch pumps already in?

A. No, sir; they would have been able to hoist the water, except that towards the very last there would have been occasion to use

the hoisting machinery. This must only cover up to the time when they met the headings running east. After that time it would become, in this supposed case, also necessary for them to put in such contrivances as they have actually used for carrying the water out eastward. This has nothing to do with that. There is the difficulty I have had in answering all the way through. They would not obviously pump up the central shaft after they cut a hole through eastward, but there was a pool of water to be lifted up the 12 or 13 feet.

Q. It would run out the other way of itself, wouldn't it?

A. They had a little bench 12 or 13 feet high over which they had to lift all their water.

Q. Still it was a comparatively easy thing to pump that water over the bench?

A. Exactly; but when I speak of furnishing pumps, I have to think of that as well, as one of the things introduced into this evidence.

Q. They would not have had so much bench if they had had another 11-inch pump in, and had used their hoisting machinery for hoisting rock?

A. They would have had the same height of bench.

Q. Yes, but not so long?

A. No, it would not have been so long. When you spoke of "so much," I was thinking of height of pumping only.

Q. (By Mr. TRAIN.) If I understand the result of your testimony, it is this, that they might have put in sufficient pumping-power in season to enable them to comply with the contract by carrying the headings 80 feet per month?

A. Of course, when they struck the east heading, then the bench would have been shorter than it was when they left it.

Q. (By the Committee.) Did they change the 5-inch pump to an 8-inch after this 2d of March?

A. Yes, sir.

Q. Well, what would have been the difference in time between putting in an 11-inch pump at that time and changing the 5-inch to an 8-inch pump?

A. Well, I think the very fact of their undertaking to use it in connection with present power, and that interruption of the present work, made the work go on slowly. The mere matter of putting in the pump of itself could have been done much more quickly if they had made it a job to be accomplished, instead of a thing to be done in connection with their work of excavating.

Q. (By Mr. ALLEN.) That is, their fault was that they were trying to hurry on the excavation; they were too anxious to work on the excavation?

A. That is the substantial fact.

Q. (By Mr. TRAIN.) If they had put in an additional 11-inch pump, they would have put in additional steam-power and used it, would they not?

A. They would.

Q. That is, the pumping would not have been interfered with at all, while they were putting in an 11-inch pump?

A. The hoisting of rock would have been interfered with, but the baling of water to a certain extent would not have been delayed.

Q. (By the Committee.) Would they have had to stop hoisting rock to put in a new pump?

A. Yes, sir; they would have been hindered very largely.

Q. (By Mr. ALLEN.) The question is, would they not have had to stop, if they had put in an 11-inch pump there?

A. They would have had to stop during a certain period of the progress of the work. You see the whole question was one of policy.

Q. (By the Committee.) Was there not just as much interruption to the hoisting machinery in putting in an 8-inch pump as there would have been in putting in an 11-inch pump?

A. There was this difference, that, in order to put in an 11-inch pump, they would have to put heavier timbering into the shaft, which would have been a source of hindrance to the work.

Q. (By Mr. TRAIN.) What would have been the difference in point of time between putting in the timbering requisite for an 8-inch pump and the timbering requisite for an 11-inch pump?

A. Very considerable difference.

Q. (By the Committee.) Would it have necessitated anything more than larger sticks of timber?

A. There would have been more of them. The size of the sticks is a matter of convenience. They make them as large as they can conveniently handle, but there would have been a larger grouping. It would have required more steam-power.

Q. If you had been doing it yourself, would you have stopped the work and put in another pump?

A. That would have been the quickest way of getting through.

Q. (By the Committee.) Would you have done it,—that is the question?

A. It is simply a question whether I would have chosen to seek another way of doing the thing. I don't think that the option was left. It was a matter for immediate decision; a matter which I referred to the council, stating the exact condition of affairs.

Q. (By Mr. LOVERING.) If you had been doing the work as an



engineer, would you have stopped the hoisting and put in a pump? Would you then have given orders to stop the work and put in a pump?

A. I should not have given orders to stop the work; but if conducting the work under the instructions which I had to get it done as soon as possible, I should have got the pumps in as soon as possible, and larger pumps.

Q. If you were the contractor doing the work?

A. There comes in another question. Here was a question of very large expense, which I referred for advice; it was a question of assuming a very considerable expense, in order to expedite the work.

Q. How long would it have taken, provided this work had been stopped, to have filled this shaft with water; would it not have filled up, so that they could not work it afterwards?

A. There would have been no need of stopping the work; it never would have filled up; I don't know that anything I have said implied that.

Q. I don't know that it has, only it occurred to me that if the baling was stopped, and 200 gallons a minute came into the shaft, it would have filled it up very soon.

A. The putting in of another pump at the other end of the shaft would not have necessitated the stopping of the pump already in.

Q. You would have had to put in another engine to pump?

A. That could have been put in the other side of the shaft. They worked this smaller pump from the same engine that worked the other pump. If Mr. Shanly had put in another big pump, he would have been obliged to put in a new engine to work the new pump.

Q. (By Mr. CUMMINGS.) What would that have cost, probably? Mr. Shanly says it would have cost \$55,000.

A. I should think that a large estimate, but I have not had occasion to investigate that matter particularly. I think there are charges of that kind which go to swell up Mr. Shanly's statement, which are not properly chargeable to the cost of pumps.

Q. Those instructions came from the governor and council to go on with that work there?

A. Yes.

Q. Did the governor and council investigate it themselves, or did they get their information, upon which they ordered Mr. Shanly to go on, from you?

A. I felt that they had been fully advised from the beginning as to the fact that these difficulties were encountered, and it was a question only, as I apprehend, whether this difficulty constituted a sufficient reason for departing from the terms of the contract.

Mr. ALLEN. You are asked how they got their information?

A. From myself.

Q. (By Mr. CUMMINGS.) No committee of the council went up there and examined it, when this difficulty arose from water?

A. Not on the ground; no, sir.

Q. Where did they get their information upon which they acted, can you tell?

A. I suppose from the consulting engineer and from my information, both. My orders came from him.

Q. From the consulting engineer, Mr. Philbrick?

A. Yes, sir.

Q. He was there?

A. He was generally there. He was fully acquainted, as I apprehend, with all the circumstances.

Q. You think they acted on your representations in ordering the work to be prosecuted west from the central shaft?

A. They acted on my information, certainly, as to the exact condition of affairs. That was all I had to do.

Q. (By Mr. LOVERING.) At the same time you say you would have stopped work to put in a pump?

A. I said that I would have stopped the work only so far as was absolutely necessary to get in the pump.

Q. What was your habit in examining this work? Were you in the habit of going down the shaft and looking at it yourself?

A. I was, whenever there was anything that required it.

Q. (By Mr. MOSELEY.) Was Mr. Philbrick in the habit of going up there and going down the shaft and examining the work personally, or did he take it on your judgment?

A. Both.

Q. How often did he examine it personally,—once a month, or once in six months?

A. He always visited me once a month, and went over and made an examination of the work.

Q. Was he in the habit of going down the shaft and looking at this water, and seeing what progress it was making, when he came?

A. Not always. But he was in the habit of doing what was most essential and important; that is, of keeping track of how much water there was, and of looking over the notes and informing himself what the amount of water was.

Q. How do you get at the amount of water? From what is drawn out from the bottom?

A. Yes, sir.

Q. And by measuring what there is in the hole?

A. By measuring what there is in the hole and what is thrown out.

Q. He was practically conversant with that?

A. I presume so.

Q. From his own knowledge, or from your statement?

A. The two things came so nearly together that it would be very hard to tell. The observations were made every time that the conditions allowed of it, to show the quantity of water in the Tunnel.

Q. What conditions do you allude to?

A. I mean to say when it would be of any advantage to arrive at a measurement of the water. There would be sometimes several days in succession in which the baling was so interrupted and irregular, and the pumping so interrupted and irregular, that we couldn't keep track of how much they did pump up and throw out in a day; but we would select certain days when their machinery was working straightforward and without interruption, and during those days would note the quantity of water they threw out, and the quantity left in the well, and out of the two the computation was made.

Q. (By Mr. CUMMINGS.) Did you judge that it would expedite the final completion of the Tunnel to have them stop work and put in another pump?

A. Yes, sir. That is, to stop work only so much as was absolutely necessary for the purpose of putting in that pump.

Q. (By Mr. TRAIN.) There was a committee of the council on the Hoosac Tunnel?

A. There was.

Q. And they got their information from you and Mr. Philbrick, did they?

A. Yes, sir.

Q. Did they not make a personal examination of the work, from time to time?

A. They did. I understood the inquiry to relate to this particular moment.

Mr. MOSELEY. I wanted to find out whether the council got their information from this gentleman or from Mr. Philbrick, or from their own personal examination.

Mr. TRAIN. They got it from all three.

Mr. MOSELEY. He has not said that yet.

Mr. ALLEN. If he can fix any time when they were there between January 18, 1872, and June, 1872, I should like to know it.

Mr. TRAIN. I think I can fix that fact, if you want it. I don't know that I can by Mr. Frost.

Mr. ALLEN. He has said the committee were not there.

WITNESS. The question was as to this particular juncture, when the increased flow of water occurred.

IN THE CONTRACT WITH W. & F. SHANLY AT THE HOOSAC TUNNEL.

*Comparative Statement concerning Tunnel Excavation, showing the quantities originally estimated, and the actual quantities done, at the prices established for Monthly Estimates.*

The Schedule of Estimate made in December, 1868, showed the quantities and prices of work remaining to be done as follows:—

	Solid Rock, cubic yards.	Prices.	Agg'te Quantities, cubic yards.	Resultant Values.
In the length which had been penetrated from the East End. "Tunnel Enlargement and Heading Enlargement," . . . . .	Tunnel Enlargement, : 4,500 Heading Enlargement, : 28,000	\$16 00 9 00	} 32,500	\$324,000 00
In the length not yet penetrated. "Tunnel Extension," . . . . .	Eastern Division, : 85,100 Central Division, : 82,270 Western Division, : 82,940	11 00 14 00 12 00	} 250,310	3,083,160 00
In the length which had been penetrated from the West End. "Heading Enlargement," . . . . .	Heading Enlargement, : 52,800	9 75	52,800	514,800 00
Totals estimated in December, 1868, . . . . .	. . . . .	. . . . .	335,610	\$3,921,960 00





TUESDAY, March 16, 1875.

TESTIMONY OF BENJAMIN D. FROST—*Resumed.*

Q. (By Mr. TRAIN.) Have you this morning the computations by which you can show the difference in dollars to the contractors, between performing the contract as an entire contract, and performing it under the item contract, which was at first contemplated?

A. I have no doubt that I have. I have them in town certainly, and probably here. These concern quantities of tunnel excavation; the other quantities are, of course, not subject to suitable comparison, because more indefinite and variable, and partially adjusted by the Council, and partially deducted as incomplete, on the final settlement. The main features of the contract are in the items of rock excavation of Tunnel. As to those, I have this statement. The sum and substance of it is, that by the original quantity estimated, the cost of the excavation alone would have amounted to \$3,921,960, with excavation of the size of the Tunnel, according to the quantities that I assumed and estimated as probably those that would finish it.

Q. Under the items?

A. Yes, sir.

Q. Now, what did he actually receive?

A. The actual final computation—of course, he received his whole price—but the computation makes the value of the Tunnel excavation, \$3,843,481.

Q. Now, then, we will go back for a moment to this matter of the flow of water. I find in Senate Document No. 201, of 1874, a partial record of observations embodied in your report.

A. Yes, sir.

Q. That terminates October 8, 1872. It is a report of Mr. Frost to Joint Standing Committee for the year 1873. That table I assume to be correct.

A. It is believed to be. I think I actually revised the proof of the thing, to make it sure.

Mr. TRAIN. That shows, Mr. Chairman, that on October 8, 1872, the flow of water was  $208\frac{7}{10}$  gallons, on page 14.

Q. Now, if you have brought the table down to a more recent period, so as to show the greatest flow, I would like that.

A. I have carried it forward, year by year. The greatest flow, between May 23 and June 10. I have made a pencil memorandum of the year 1872, that the flow rose up to 250 gallons, being 13 gallons more than on the printed statement.

Q. Between when?

A. If I recollect rightly, it was between May 23 and June 10.

Q. In 1872, it rose to 250 gallons?

A. Yes, about 250; but the computation was not so accurate as to make me entirely willing to place it among my recorded observations. That, in general terms, was the highest flow ever encountered for six months next ensuing.

Q. That would take it up to November?

A. I will go further; for the year next ensuing, January 14, 1873, there were  $142\frac{7}{10}$  gallons a minute; April 1,  $177\frac{7}{10}$ ; June 7,  $143\frac{14}{100}$ ; then, from that time forward, there was no very good opportunity for testing the amount. It will be remarked, that a certain amount of water had begun to flow eastward at that time, so that these figures can be hardly regarded as the full statement; but on the 20th of November, the working of 1873— I don't know as that is important, as the other was the end of the pumping.

Q. What, June 7?

A. Yes, sir; that is to say, the pumping was discontinued some time in that summer. The pumping was discontinued at the end of the statement you got in 1872.

Q. (By Mr. TRAIN.) Up the shaft?

A. Yes, sir; but they had to pump over the bench till the middle of the summer.

Q. Mr. Frost, by whom was the Haupt Tunnel used—by the Shanlys or their sub-contractors?

A. By their sub-contractors, almost entirely.

Q. When did the sub-contractors cease to use it? When did they get through with their work?

A. I should have to find out myself; in June, 1872, substantially; there was other contract work; that is, a little, but that is substantially the statement.

Q. How long did they use the Tunnel, then, afterwards?

A. There was a subsequent sub-contract made extending that to a later date, but there was a stoppage at that time.

Q. Well, I want to know when the sub-contractors finally had completed their work, so that they did not use the Tunnel at all for the purpose of ascertaining how long a time that Haupt Tunnel remained disused after the sub-contractors had got through?

A. The subsequent use was so small that this may be said substantially to be the date you ask for. Up to that time it was in continuous and constant use by them.

Q. Well, what use did the Messrs. Shanly put the Haupt Tunnel to afterwards, if any, before it was broken down by the State?

A. I do not recall at this moment any other use except a desultory occasional use for a few days, except for taking out some portion of the material for the façade at the west end.

Q. Did they use the west shaft instead of the Haupt Tunnel to remove their material?

A. Substantially, the Haupt Tunnel was for their sub-contractors.

Q. Now, then, what use did they wish to make of it finally after the State had broken it down; what use did they wish to make of the Haupt Tunnel; they subsequently used the open cut instead of the Haupt Tunnel, but for what purpose?

A. For hauling out their deposit of rock that lay in the bottom of the Tunnel. It was not their custom, during the progress of the excavations, to take out all the broken rock,—usually a deposit of about one foot depth, or more, remained in the floor of the Tunnel; finally, it became a very considerable deposit.

Q. Well, that was run out after they completed the west shaft?

A. Yes, sir.

Q. After the west shaft was stopped up?

A. Yes, sir.

Q. When was that?

A. In the fall and winter of 1874; fall and early winter, of course.

Q. You mean last fall.

A. I mean so.

Q. How much time did it take to remove that material?

A. My impression at this moment is, that they closed the west shaft in October; but it was during the autumn, some time.

Q. Might not that Tunnel have been utilized for the purpose for which they afterwards used it, during the summer of 1874, or for a longer period?

A. During the summer of 1874 was the very time when they couldn't have it, and when they complained because of being deprived of its use.

Q. Well, prior to that, then?

A. Prior to that; yes, sir.

Q. Well, what period of time was there when they might have used it that they didn't use it?

A. I should say there was no objection to their using it from June, 1872, to the latter part of 1873, if they had chosen to keep it in order. I will answer that, and then add a clause.

Q. Well?

A. During that space, their sub-contractors did make occasional



use of it, sometimes over a month or two at a time, but it was their sub-contractors all the time, I believe.

Q. When did you begin to break down the Haupt Tunnel, so that they couldn't use it?

A. In the winter of 1873 and 1874, during that time.

Q. When was the open cut completed, so that they could use that?

A. It was nominally completed, so that they proposed to use it, the latter part of September, 1874. But they used it, with interruption, although there was a way made through; there was a contractor working there, so that part of their charge for hindrance grows out of his getting in the way.

Q. What was he connected with?

A. He was connected with the railroad contract for which the State is responsible. The best was done possible to keep out of their way.

Q. Well, then, if they had completed their contract by the 1st of March, 1874, they would not have been interrupted at all by the breaking down of the Haupt Tunnel?

A. Yes, sir, they would; they would have been interrupted.

Q. No, not if they had got through the 1st of March, 1874; you didn't touch it in the winter of 1874.

A. I did; yes, I said that I touched it in the winter of 1873 and 1874, and that kept them out of it, so to speak, thenceforward, till the date I mentioned.

Q. As I understand it, there was a long period after June, 1872, when the Haupt Tunnel was not used by anybody, except occasionally by the sub-contractors?

A. That is the fact.

Q. And in January, 1874, you broke it down?

A. That is what I answered; the winter of 1873 and 1874.

Q. Well, they were bound by the original contract to have got through the 1st of March, 1874; now, if they had completed their contract according to its terms, I want to know if they would have been interrupted in the use of the Haupt Tunnel to any extent by your operations?

A. If I had gone on in just the same way as I did, they would have been obstructed.

Q. From January to March?

A. Yes, sir; from December to March.

Q. When they left the Tunnel, had they removed all the loose rock that was necessary to be removed, in order to make it safe overhead for the passage of trains?

A. No, sir.

Q. I want you to exclude the arching part?

A. I do; there were some other parts. The matter, you must recollect, concerning which you ask, has a wide range of judgment; that is to say, I should have insisted on a little more work, but it was thought best not to press them further.

#### CROSS-EXAMINATION.

(By Mr. ALLEN.) Mr. Frost, the other day, after we adjourned to meet Monday, I understand that you asked the Committee to wait because you wanted to get some papers that were very important. What were those papers?

A. It was simply what you had asked me regarding this matter of pumping, and my recollection was not clear about it.

Q. Was it these details about pumping that you have given now?

A. I wanted to refresh my memory about the subject.

Q. The amount of water pumped?

A. Well, I might have had other items in my mind. You approached matters with which I had not had any late occasion to be familiar, and which I did not therefore fully remember, and I naturally desired to so far review the matter as to refresh and complete my recollection.

Q. The matter of pumping?

A. I should suppose, generally, any questions you might have asked me, so far as I recollected then, I would have desired to look over.

Q. Didn't you tell the Committee there were certain very important papers you had got to get, must have? Did you, or did you not?

A. I am sure I don't recollect what I said. I told them in general terms that you had approached a matter of importance to this case.

Q. Who had?

A. You,—a matter of importance to this case, a matter which had entirely escaped my recollection; hadn't been the subject of conversation with me since the matter transpired.

Q. You know I didn't put any of those questions?

A. Well, perhaps I should say the counsel on the other side.

Q. Don't you think you should?

A. Perhaps I should, sir. I understood you wanted me to fasten on somebody, and I fastened on you in regard to certain questions.

Q. Did I introduce those questions?

A. I can't tell what part was introduced by you.

Q. It was this matter of pumping, was it?

A. I didn't answer that, sir. I said that any questions you might have asked.

Q. Well, you wanted to make a little more general preparation first for your examination than you had already made?

A. I didn't think it becoming, that a matter so important as in this case, should be approached with not even the fact of having looked at anything concerning it, because I didn't think of the inquiry taking that range.

Q. Hadn't you been in consultation with the attorney-general day after day in regard to this?

A. No, sir, I think not.

Q. It was an entire surprise to you when those questions were put to you?

A. My dear sir, I have brought in here these diagrams, and have come prepared to answer questions touching this thing. It was suggested to me by the attorney-general, that I should be prepared to answer certain questions, and to make such preparation as occurred to me, but it was not unnatural in the prosecution of the inquiry that a good deal should come out which didn't occur to me.

Q. Now, in regard to the first 800 or 810 feet from the east portal. At the time you made your estimate of the amount of work that was to be done for the completion of the Hoosac Tunnel in 1868, on which Mr. Shanly made his contract, did your estimate of work to be done include any work on that first 810 feet?

A. No, sir.

Q. Did you make a report to the commissioners on the Hoosac Tunnel that that 810 feet was entirely completed?

A. In the term—

Q. Won't you answer my question? Did you make a report to the commissioners on the Hoosac Tunnel that that 810 feet was entirely completed?

A. My term was—"excavated to full size," as nearly as I recollect it.

Q. Didn't you report to them that it was excavated to nearly full size?

A. Those are my words, I believe, from recollection. Whether I gave them a written report to that effect, of course, I don't know. Undoubtedly, I gave them substantially that information.

Q. Did you consider that it was entirely completed at that time?

A. I considered that it was, just in the words I said, "excavated to full size."

Q. Well, did you consider that it was entirely completed?

A. It was not entirely completed, as that statement shows.

Q. Did you consider at that time that it was entirely completed?

A. It depends entirely on what you refer to as "entirely completed."

Q. I ask you what you thought?

A. Well, I say the excavation—

Q. Did you consider yourself at that time that the Tunnel for that 810 feet was entirely completed?

A. The Tunnel is made up—

Q. Can't you answer that question, sir?

A. No, sir, because I want to know what you mean by the word "Tunnel," then I will answer it. When you define your meaning, I will answer your question so that I can be understood.

Q. Did you think there was any more work to be done in the excavation for that 810 feet at that time?

A. I did not, excavation of solid rock.

Q. Did you know anything about this reprint that was made of this document last year?

A. I read it over, and saw some things.

Mr. TRAIN. Is it one of the documents of last year?

Mr. ALLEN. Yes, sir. No. 150.

Q. Did you read it in proof?

A. I didn't know anything of its existence until it came to my notice by accident. Some gentlemen had a copy last autumn.

Q. You knew nothing about the circumstances of its being reprinted last year?

A. No, sir. I don't even remember the fact.

Q. You don't know how that paragraph that I call your attention to happened to be omitted?

A. No, sir, I do not.

Q. Won't you look and see if that is your report? I will thank you to cast your eye upon that paragraph I have marked, on page 68, and see whether you reported to the commissioners that that 810 feet was entirely completed?

A. Shall I read the statement?

Q. I will thank you to answer my question, whether you reported to the commissioners that that 810 feet was entirely completed?

A. I was describing the progress of excavation, therefore it is right that the preceding paragraph should be read in connection with my answer, I should think. I am, of course, subject to orders of the Committee in that matter.



Q. Did you make a report that that 810 feet was entirely completed?

A. When I am speaking about excavation, I think I should append that as the heading, when I said excavation entirely completed.

Q. Is that your language that you used last?

A. The word "progress" means progress of excavation.

Q. Is that your language?

A. That is my language, as I remember it.

Q. Your language is, then, that this 810 feet is entirely completed, isn't it?

A. If you take up the heading of the paragraph, you can so read it.

Mr. ALLEN. I don't see any heading.

Mr. Allen then read from page 68 of the report referred to, as follows:

"The following statement exhibits in general terms the total results which have been attained in actual progress of the Tunnel up to the present date.

"At east end, the total distance penetrated is 5,282 feet, or two feet over one mile. Of the first half mile of this distance, a length of 810 feet is entirely completed."

Mr. FROST. If you will allow me, I can say in five words what I wish to say. I had reason to believe that the excavation of the first 810 feet was completed.

Q. You had?

A. Yes, sir.

Q. What reason did you have to think so?

A. The statement of the men that did the work, and so far as it was visible to me.

Q. Did you tell Mr. Shanly that that was completed?

A. If he asked me the question, I should have told him so. As nearly as I recollect, I did.

Q. Did you furnish any diagrams for him to do any work east of that point?

A. If I did, they were furnished afterwards; not at that time, when he called upon me.

Q. Then, at the time when the Shanly contract was made, and he commenced his work, you regarded that section of the Tunnel as entirely completed, so far as the excavation was concerned?

A. Yes, sir.

Q. How happened you to discover that it wasn't finished?

A. Well, it isn't my business to take reports of anything.

Q. Didn't you think it was finished according to a reasonable construction of the contract?

A. Well, I did think so at the time he began his work.

Q. You were an engineer, and were in charge there, weren't you?

A. Yes, sir.

Q. How long had you been in charge?

A. For a year.

Q. You had been at that time?

A. Yes.

Q. When did you begin to be the engineer in charge?

A. Beginning of 1868.

Q. You had been in charge of the Tunnel for a year, and you assisted in drawing up this contract, did you not?

A. I did.

Q. And at that time you did regard that portion of the Tunnel as entirely completed, so far as excavation was concerned?

A. So far as excavation of solid rock was concerned.

Q. You didn't expect that he would have any work to do there at that time in excavation, did you?

A. I did not.

Q. And if you said anything to him about it, you said what you have stated?

A. Yes, sir, I presume so.

Q. And you furnished diagrams beginning at that point, showing that his work began at that point, 810 feet from the portal?

A. Yes, sir.

Q. Now, did you require him afterwards to go on and do work in there in that 810 feet?

A. Yes, sir.

Q. Won't you see if that is your letter? [Dated March 22, 1871.] Is that your writing?

A. It is my writing, certainly.

[Letter read.]

Q. You did direct him to go on and do work commencing from the portal?

A. I did embrace that in my orders.

Q. Now, let me know if this is your letter? [Dated May 6, 1871.]

A. Yes, sir; there is no mistake about it.

[Letter read.]

Q. Is that a copy of one you received?

A. I haven't that here, sir; but I can undoubtedly identify anything in it that is of any consequence.

[Letter of May 8, 1871, from Messrs. Shanly to Mr. Frost, read.]

Q. Now, will you look at this, and see if this is your's? [Letter of August 5, 1871, from Mr. Frost to Messrs. Shanly.]

A. Yes, sir.

Q. I want you to listen to this, Mr. Frost, because I want to ask you a question or two about it. [Letter read.] Now, at the time when you wrote that letter to him, did you really suppose that you had not treated that 810 feet at the east end as finished?

A. I had regard directly to the words of the contract.

Q. Did you really think, at the time you wrote this letter, that you hadn't regarded this as finished work?

A. I am now not able to recall the exact words.

Q. I ask you, Mr. Frost, whether, at the time you wrote this letter, your understanding really was that that 810 feet at the east end had not been handed over to him as finished work?

A. I must appeal directly to the words of the contract for my guidance.

Q. I am asking you what your understanding was in your own mind at the time you wrote this letter?

A. At the time I wrote that letter, I wrote candidly what I believed; and when I go further and explain, you will see why I believed so.

Q. Did you understand at that time that that portion of the Tunnel, of 810 feet at the east end, had not been considered as finished work at the time he took his contract?

A. You have crowded me to amend the statement that I made awhile ago, when you asked me what I told Mr. Shanly. I tell you, if he asked me anything about it, that I undoubtedly told him it was completed; that I probably told him it was completed. The contract is distinct in saying that the whole Tunnel—

Q. I am not asking you anything about the contract. I am asking you whether you understood, at the time you wrote this letter, that that 810 feet hadn't been regarded as finished work at the time when the contract was made? Now, answer that question, please.

A. At the time when the contract was made, I am not now able to recall what was said. Mr. Shanly, probably up at the work when he was making up his figures, was told that that 810 feet was complete.

Q. Well, you have said that before.

A. At some later date, according to the best of my recollection, before the contract was signed, his conversation brought up again that question, whether that 810 feet was complete. I told him I believed it to be so nearly complete that he wouldn't want to quarrel

for the little that should remain to do ; that I had ordered it to be completed.

Q. Now, I will thank you to answer the question, and not make a speech. At the time you wrote this letter, on the 5th day of August, 1871, did you understand that this 810 feet hadn't been regarded as finished work at the time when the Shanly contract was made?

A. I suppose that Mr. Shanly will not fail to remember this conversation, in which I told him that I had not examined to know that it was completed. I had ordered it to be finished, and supposed it was.

Q. When did you have that conversation?

A. Within a mile of this point.

Q. I asked you *when* you had it?

A. I told you distinctly that I couldn't recollect whether it was before or after the signature to the contract.

Q. Was it before or after you handed him the diagrams to show where he was to begin to work?

A. Yes, sir ; it was a long time before that.

Q. Why did you furnish him diagrams showing him where he was to begin the work at 810 feet east of the portal?

A. The work of the first 810 feet belonged to the work of trimming, and was not proper to be commenced at that time. I had not the patterns made to indicate the trifling changes and comparatively small excavations.

Q. Well, you mean to say that you did consider, at the time the Shanly contract was made, that there was some trimming to be done in that 810 feet?

A. My language shows distinctly what I thought. I didn't think it amounted to anything, because I thought it had been faithfully done. I had ordered it to be made.

Q. Did you think there was any trimming to be done at the time the contract was made?

A. Substantially, none of any considerable amount.

Q. Did you think that when he wrote to you that letter, to which this was in reply, that he had made a mistake, and had in mind the language of the contract in regard to the west end of the section?

A. I really did believe so.

Q. Did you, indeed ! Mr. Frost, when the question came up, whether Mr. Shanly should have his compensation for doing this work in the 810 feet at the east section of the Tunnel, I should like to ask you whether you advised in favor of paying him or against paying him for that item?

A. I really don't remember ; couldn't tell.



Q. Well, did you give any advice on the subject?

A. I don't think I did, except to state the facts. That is my impression. Your inquiry, you see, covers all I have said for the last seven years.

Q. No, sir, it don't; it covers what was done in the month of December last, when Mr. Shanly asked the governor and council for compensation for doing that work, 810 feet. Whether or not you advised the governor and council whether he ought or ought not to be paid, that is what I want to know?

A. Well, I advised them simply of these facts. I don't think I intruded any advice as to what they should do.

Q. What facts did you tell them? Did you tell them this conversation?

A. My impression is that I did not, because I did not at that time consider it material in the discussion.

Q. Was your opinion asked at all, whether that item should be allowed?

A. I don't remember.

Q. Did you express an opinion as to whether it should be allowed or not?

A. I don't remember to have expressed an opinion about it.

Q. You didn't tell the governor and council that in your opinion it ought to be allowed, did you?

A. Well, sir, I really can't tell.

Q. You cannot?

A. That is the fact.

Q. Did you have any opinion about it, as to whether it ought to be paid or not?

A. Well, I don't think it was my business to have an opinion about it at all. It was a legal question.

Q. Well, did you have an opinion about it one way or the other, as to whether that ought to be paid? Can't you answer?

A. I am trying to think whether I did consider the matter at all. It didn't occur to me whether it was necessary for me to.

Q. Well, since it is so difficult, and takes so much time, I will pass to that matter about the central drain. This is an item for 5,017 feet from the east portal, you have already stated?

A. I have a right to make one explanation. The consideration of the council was, as I understand, directed to the legal question; the question of equities was another matter.

Q. Now, going on with this question of the central drain, this was a charge for deepening 4,816 feet of the central drain, and reconstructing 201 feet from the east portal. How did it happen that that portion of the central drain, forty-eight and odd hundred feet,

which you testified was imperfectly constructed at the outset, and timbered over,—how did it happen that this wasn't properly constructed at the outset?

A. Well, sir, I don't know. It seems to be a habit on all public works, that unless there is a very rigid supervision, men won't do things right. It was a good deal better for the men doing the work. I can imagine that they made a better show of progress by not making it complete.

Q. How did it happen to escape your observation?

A. I couldn't see it. It was covered up with timber. I had to take it from information.

Q. Whose?

A. The information of the superintendent employed by the State, and others who had been employed there.

Q. Was there any debris in the bottom over the timbers, any difficulty in examining to see whether it was completed or not at different points?

A. The only way it could have been done was to tear up every point of examination, which would have cost considerable money.

Q. You didn't make any such examination?

A. I did not.

Q. Did you regard that central drain as completed at the time when the Shanly contract was made, with the exception of covering it with stone?

A. I did so consider it.

Q. You supposed it was sufficient from the best information you had?

A. I had reason to suppose so.

Q. Did you represent it so to Mr. Shanly?

A. I did so represent it.

Q. You made afterward a diagram, I think, in the latter part of March, 1869, of what work remained to be done?

A. Yes, sir.

Q. Do you remember whether you represented that 5,000 feet, or thereabouts, was completed in the central drain?

A. I ought to have done so from my information at that time. I have made so many diagrams that I don't remember how that one looked.

Q. Have you any doubt of it? Do you remember the diagram?

A. I remember the diagram.

Q. You remember you did make such measurements?

A. I do.

Q. And in making them, in setting down what was the actual

condition of the Tunnel, have you any doubt at all that you set down the central drain as completed at that time?

A. No, sir. I have no doubt of it.

Q. And this was three months after the Shanly contract was made in March?

A. Yes, sir.

Q. Was any of that work done under your direction?

A. There was a certain length.

Q. How much?

A. I couldn't tell you.

Q. Well, I see in your report of the work done in 1868 to the commissioners, you say 2,256 feet done in that year. That is on page 59. Was that amount done under your superintendence?

A. If so written, it was.

Q. Well, did you have charge of the construction of the central drain for that distance?

A. Yes, sir; the general charge.

Q. Well, how could it escape your observation, if it wasn't made deep enough?

A. I had so much on my hands that I hadn't time to notice small matters.

Q. Was that so small a matter, as to whether the bottom of the drain was within a foot of the grade where it ought to be, that you hadn't time to notice it?

A. It was a matter not possible for me, carrying on that work, and keeping a supervision of the large force of men employed, to take an instrument and run out the grades and ascertain.

Q. Did you accept that 2,256 feet of the drain as completed according to the true grade?

A. I did in dealing with Mr. Shanly.

Q. Well, did you accept that drain as finished, and allow it to be covered up with timber as finished work, when you had charge of that half a mile?

A. I did.

Q. Without knowing whether it was right or not?

A. I did not know.

Q. You afterwards found that it was not within a foot of the bottom, where it ought to be?

A. I guess "within a foot" is rather an extravagant statement for the highest point of rock anywhere.

Q. Did you ever change the grade of the Tunnel after that, in that portion of the Tunnel?

A. No, sir. There was no change made.

Q. This could not be accounted for on the supposition of any change of grade, could it?

A. I think not.

Q. It was simply a matter for your consideration, whether this work done under your care was completed, or, in fact, was not completed, and hadn't reached the proper grade?

A. It is simply a matter of unfaithfulness on the part of the men, or want of knowledge.

Q. And not detected by you?

A. And not detected by me; and I am not sure, under the conditions of haste, if I had found it out, I should have had it deepened at that time.

Q. Won't you see if that is a letter of Mr. Shanly to you, and your reply on the other side, concerning this matter?

A. I recollect it. That is my writing.

[Mr. Shanly's letter of August 7, and Mr. Frost's reply of August 13, were read.]

Q. Now, when the Messrs. Shanly presented that account to the governor and council, why wasn't it paid for under these circumstances?

Mr. TRAIN. I suppose the report shows that.

Q. Well, what did you advise, if anything, about paying that item; did you advise it was a just item, as claimed there, or not?

A. I told them these facts just as I told you.

Q. Do you mean to put the governor and council in that situation of having declined to pay these claims?

A. I certainly thought they understood me; if they failed to understand me, then it was my fault.

Q. You stated the facts to the governor and council, and then they declined to pay these claims because of what you have told here; now you mean to say that you did tell these facts, on your responsibility as a witness, to the governor and council, and that they declined to pay this claim; that is what I want to know?

A. I mean to say that I intended to communicate these facts to the governor and council.

Q. I am asking, as a matter of fact, whether you put them in possession of this information?

A. I think I did.

Q. When?

A. By verbal communication when this was made a matter of discussion. When you say the governor and council, I should say certain members of the Tunnel Committee.

Q. Which members?

A. I couldn't tell you.



Q. Tell me a man of the governor's council, if you can, that you have told these facts to, and I would like to ask him whether his recollection is the same?

A. I will state, in general terms, that I came here to see the members of the Committee, as a committee. Such members as I met I talked to; I didn't always recognize whether the same members were always present at the succeeding interviews concerning this matter.

Q. Can you tell me a man of the executive department to whom you told these facts in regard to this claim?

A. Mr. Allen, if you had as many men to talk to as I do, you would not be surprised that I can't remember.

Q. Can you tell me, are you willing to name a man of the executive department to whom you gave these facts before they passed on this claim?

A. I told you at the outset that I believed I gave them all the facts.

Q. I want you to name a man that I can call on?

A. It depends entirely upon my general recollection of an intention to do so; it is not possible for me to identify the man I told them to.

Q. You won't expose yourself to the chance of any man being called in here and saying whether he ever heard these facts?

A. Well, sir, I will invite the whole Tunnel Committee, and ask them if they don't remember, and if they say they do not, I will say I did not make myself understood as I intended to make myself understood.

Q. Did you think that any of them understood the facts before rejecting the claim?

A. I do not understand that it is my province to pass upon possibilities or impossibilities.

Q. You recognized it as a just claim, didn't you? Wasn't the construction of your own letter that this was a just claim?

A. My business was to carry out the contract.

Q. Wasn't the construction of your own letter that this was a just claim for extra work?

A. I should have to read the letter through; I simply saw my handwriting. I was reading these telegrams while you were reading the letter.

Q. Now, I want to ask you about that item of the grading of embankments at the east end. You say that \$600 was allowed to Mr. Shanly for work done on the embankments while the railroad was in Mr. Field's care, and not under your own?

A. Yes.

Q. It was, if I recollect right, in June, 1870, that Mr. Field died?

A. About that time.

Q. He, up to the time of his death, was the engineer who had charge of the railroad east of the east portal of the Tunnel?

A. The bridge was made, for convenience, the dividing line; that is, the bridge over the Deerfield River.

Q. Did you have any charge of that before his death?

A. No, I didn't conceive that I did.

Q. Where did the limit of your duty end?

A. With the bridge over the Deerfield River, as I considered; no precise limit of division was defined. Mr. Field and myself talked about it sometimes.

Q. This allowance that was made, was made, as I understand it, for work that was done before you came in charge of that part of the road?

A. It might be said to be so. That was the fact.

Q. It wasn't at all for any work done under your superintendence?

A. No.

Q. But under Mr. Field's, and the reason for the allowance was that you didn't know exactly what directions Mr. Field might have given?

A. Yes, sir; that is the fact.

Q. Did you recognize anything as extra in regard to the grading of embankments that was done while it was under your charge?

A. Yes.

Q. What was it?

A. There is a certain amount caused by my changing the grade.

Q. Where was that?

A. Beyond and from the bridge,—that is, beyond the bridge.

Q. How much did you recognize as extra?

A. Why, I have never made up a computation.

Q. Why not?

A. Because Mr. Shanly's claim was made for the whole, and this was only a small part of the whole.

Q. I understood you the other day that there wasn't anything allowed to him for any work done as extra while under your charge?

A. I mean that nothing was paid to him, if you please.

MR. TRAIN. Except \$600.

Q. That was for work done while under Mr. Field's care?

A. That allowance covers the distance of the bank that was made before Mr. Field's death; then, for the remainder of the distance, there is a certain claim which I should have been obliged to pay

Mr. Shanly something for, except that it was included in his general claim here.

Q. But it was rejected entirely.

A. It was never presented before the council, because it was a matter of bargain between Mr. Shanly and myself.

Q. Well, but here is a charge for grading bank—\$3,511—in December last?

A. Yes, sir; but you will understand me when I say that they, having taken the general ground that they would settle up to the time when I took charge, up to a certain point, that beyond that it was incumbent somewhere for this to be considered. Mr. Shanly had given notice of his intention to bring it before the legislature.

Q. Before the governor and council, wasn't it?

(To Mr. TRAIN.) Won't you let me have that report of the governor and council on these claims?

(To WITNESS.) Did you tell the governor and council that there was something extra there that they were entitled to have for a change of grade that was made by yourself?

A. I was empowered by the governor and council,—I can't tell. I have tried to remember since that report was made out; if I told it, it was evidently not understood.

Q. You didn't succeed in getting them to understand that there was anything extra at all to be allowed for work done while under your care?

A. I was entitled to pay Mr. Shanly at my office in North Adams; I had made the bargain with him to pay him, and if the State chooses not to allow this claim, I shall have to pay him.

Q. How much?

A. I haven't an estimate, even.

Q. When he has presented his claim to the State, it don't make any difference to the state treasury, in the end, whether it comes out of your office or through the governor and council?

A. It makes a great deal of difference in the proper keeping of the accounts.

Q. You tried to make them understand that there ought to be some allowance on this item.

A. I think it more than likely it was a thing proper to be paid at North Adams, and that they wouldn't choose to consider it.

Q. Did you tell Mr. Shanly, if he would walk up to your office, in North Adams, he could get his pay for this?

A. No, sir.

Q. Did you ever intimate to him, in any way whatever, that he could get what was due to him, on this claim, by applying to you there?

A. It was an item for a few hundred dollars.

Q. Why didn't you put it into your estimates?

A. It didn't belong in the estimates.

Q. Why not, as extra work?

A. Because it was extra work outside the Tunnel.

Q. Why didn't you send in a special voucher?

A. I am prepared to make that special voucher as soon as it is withdrawn from the present account. I acknowledge the indebtedness as being outside of it.

Q. Now, it is the middle of March, and Mr. Shanly got the best settlement he could from the governor and council in December last. Have you got any other items?

A. I didn't think that Mr. Shanly, for this small amount, would want to alter his print and his record.

Q. What print and what record?

A. His voucher,—his application to the legislature. I will tell you what my intention was: At the moment when the governor and council had settled with him, it was my intention then to have made up a voucher before he got his application to the legislature in print, so that he might reduce it, if necessary.

Q. You meant for him to get all he could out of the governor and council, and then, in addition to that, you would allow him what you thought it was right for him to have?

A. No, sir; I have distinctly explained where the governor and council stopped; they were settling for matters that were not under my charge. They left the matter there.

Q. Have you got any other items up there, for which you consider he had a just claim, that you were going to allow for after he had got through with the governor and council and the legislature; is there any other item?

A. Only a voucher made out and ready for payment.

Q. What is that?

A. Well, it is for assistance furnished the engineers.

Q. By him?

A. Yes, sir.

Q. How much?

A. Well, I can't remember the amount,—it is a considerable sum.

Q. This is something since the time when he settled with the governor and council?

A. Yes, sir; I am talking about the settlement for the Tunnel.

Q. Have you got anything else under this Tunnel contract?

A. Not that I think of.

Q. You have got this item in there, you say, as you did not get



the governor and council to understand it, and that you intended to allow him something yourself,—how soon did you make up your mind to do that?

A. I proposed to do it before he got his application in print.

Q. You didn't?

A. I didn't; it is on record there that I would pay him,—on the letter; if he had reminded me at any time, I should have paid him.

Mr. ALLEN. I will give you some letters presently.

WITNESS. Do you want this information?

Mr. ALLEN. What information? I want you to answer my question.

WITNESS. I only refer to the letter to show that I had acknowledged the obligation and the debt.

Q. I was going to ask you why has not the man been paid; why hasn't he been able to get his money?

A. Because Mr. Shanly's claim embraced this, and a great deal more.

Q. And, therefore, because you thought he asked more than you could allow him, you didn't pay him what he was entitled to?

A. The account was not made up.

Q. How soon will you have that made up, Mr. Frost?

A. I shall have it made up within a week.

Q. It is the middle of March now,—how long must he wait? Why haven't you got it made up before?

A. Because it was complicated with the whole subject of claims. It was part of the labor on this embankment. If the council would have allowed him the whole, then I would have had no business to say anything about it. It was only when they declined to consider his allowance that it became my business to say anything about it.

Q. Well, it did become your business to say something about it, when they declined to consider the matter?

A. It did.

Q. Well, that I find was as long ago as last December; three months have elapsed, very nearly.

A. Yes.

Q. How soon did you expect to get round to it?

A. I told you it was overlooked, and I overlooked it until Mr. Shanly had got in his application. I proposed to mention it here, before the Committee on Claims, at the proper place.

Q. How happened it you let your chance go by until you came to the cross-examination before you mentioned it? Why didn't you mention it, if you intended to?

A. I have requested my assistant to furnish me the papers upon which I base the exact amount.

Q. Then you don't expect it for a week?

A. I directed it to be sent to me on Monday, but by some oversight my assistant mistook my directions.

Q. Is that the paper you went out to get on Saturday?

A. No, sir.

Q. Did you require this rock that he hauled out there on these embankments—one for the county road, and the other for the railroad—to be handled over by him after it was done?

A. So far as he was above grade, I required him to take it down to grade.

Q. Well, so far as he was below grade, did you require him to handle it over?

A. I suggested to him, not *required*, that economy in the building of the railroad would be accomplished by depositing the rock he had removed where it would be useful for the purpose of saving ballast, and that for such amount I should feel authorized to pay.

Q. When was this work done?

A. Well, sir, it was done in 1873, I think.

Q. What time in the year?

A. Done in the winter.

Q. Wasn't it in the summer?

A. Part in the summer, part in the winter.

Q. Day or night?

A. Whenever Mr. Shanly found it convenient.

Q. I ask you when this material was hauled out, day or night?

A. Both.

Q. Constantly?

A. Yes.

Q. Won't you look at this letter, and see if that is the letter that you got?

[Letter read, dated June 27, 1873.]

A. I remember the expression of the same sentiments exactly, and no doubt that is the letter; the sentiments are exactly what I have understood all the time.

[Mr. Allen read a letter from Mr. Frost to Mr. Shanly, dated Aug. 7, 1873.]

Q. You recollect that letter?

A. Yes, I recollect something similar to that. [Letter of Aug. 8, from Mr. Shanly to Mr. Frost.]

Q. Will you look and see if that is your's? [Letter of September 12, 1873.]

A. That is certainly my writing.

[Mr. Allen read some passages from the letter referred to.]

Q. Is this yours? [Producing another letter.]

A. Yes, sir, that is my handwriting.

Mr. ALLEN. This is simply a letter transmitting a profile of the surface.

Q. Will you see if this is the profile, with your name upon it, in your handwriting?

A. Yes, sir.

Q. See if that letter is yours? [Sept. 26.]

A. It is in my handwriting; that is all I know.

Mr. ALLEN. The letter is in relation to this same subject. It concludes as follows: "As regards the reminder of your purpose to claim extra payment for that work, my several letters of Aug. 7, Sept. 10 and 12 of the present year, sufficiently explain the course which I must adhere to unless otherwise advised by the committee of the executive council."

Mr. TRAIN. We have not got any letter of Sept. 10th.

Mr. ALLEN. No, sir; I do not know anything about that letter.

Q. Now, in that letter, you say that you propose to have him paid, by a special voucher, for the amount, as soon as the work is completed?

A. Yes, sir.

Q. Why didn't you do that?

A. Well, sir, it was one of those trifles that were overlooked.

Q. A trifle to you, but it was pretty serious to him, wasn't it? He wanted his money.

A. If he had dropped me a line informing me that that item was overlooked, I should have put it in train so that he could get the money at once.

Q. Then the reason why he didn't get it was because he didn't apply to you?

A. No, sir; it was an accident; it was simply my oversight.

Mr. TRAIN. He seems to have oversighted as well as Mr. Frost. It is very unusual for Mr. Shanly not to ask for money due to him.

Mr. ALLEN. I think we shall make it appear, before we get through, that there was a very large amount due to him that he tried to get and couldn't. At any rate, you recognize a portion of that amount as due, and, if this hearing continues long enough, you will make a computation showing how much of that \$3,500 you think he ought to have. Perhaps the committee will wait for you, and perhaps they will not.

Q. As regards the trimming of the Tunnel, and taking down the loose rock, I want to ask you if you had some question with Mr. Shanly at one time in 1872 or '73, or both, in regard to the method and extent of trimming the Tunnel?

A. I had frequent occasion to communicate with him about it, in various ways.

Q. In 1872?

A. I should have to refer to my memoranda for dates. I have no doubt that it commenced as early as that.

Q. Won't you explain the manner in which you required the trimming to be done?

A. There are two sorts of trimming. You mean after the size of the Tunnel was obtained, after I was entirely satisfied that the contractors had obtained the size that was requisite?

Q. The substantial size, yes.

A. I mean the full size; the entire size.

Q. Well, yes. Won't you explain the manner in which you required the trimming to be done?

A. What I call "trimming," was what was necessary to obtain the size. That is why I asked the question. I endeavored to assist Mr. Shanly as much as possible in obtaining that size, if that is what you mean.

Q. Will you say that there did come up a question between you and Mr. Shanly as to the requisite amount of trimming to be done in 1872?

A. It was mainly as concerning whether he should proceed with that trimming or delay it.

Q. In 1872?

A. I should think so.

Q. Did you prescribe any method to him in which that was to be done?

A. No, sir; except that he had got to get the size, so that we could get trains through.

Q. In what manner were you ascertaining whether the size was got or not?

A. Well, it was his business to find out; but his men blundered so fearfully, that I told my assistants that, as a matter of duty to the work, they ought, so far as possible, to assist these fellows in getting it.

Q. "These fellows"! What "fellows"?

A. Well, I call men who don't do their duty properly, and are not skilful enough to fill their places, "fellows."

Q. I trust you never had that term applied to you?

A. Well, I suppose you will apply it to me. I was just going to say I thought you would, before you got through.

Q. You think it would be pretty hard, don't you, if I should?

A. Well, sir, if I designate an individual—perhaps I was rather



loose in my expression. I ought to say, that some of them are very worthy men.

Q. You mean men of good moral character?

A. Yes, sir; men of good moral character, and therefore to be respected in that way.

Q. But not competent for their business?

A. Not competent for their business.

Q. And such men, whatever position they occupy, you call "fellows"?

A. They are all sorts. When you speak of a crowd of men, you speak of them very generally.

Q. That is a matter of no consequence, only I thought you used a careless expression.

A. I did.

Q. What was the method of ascertaining exactly the extent to which the trimming should be carried?

A. I made an examination, or had an examination made.

Q. In what manner?

A. By means of patterns, generally, representing the shape of the Tunnel.

Q. What sort of patterns?

A. Frame-works, built of the size of the Tunnel. That is, there would be a pattern representing the size and shape of the sides of the Tunnel, and another one representing the shape of the roof. These were set up at intervals, and we sighted from one to another.

Q. How far apart would you set those?

A. According to convenience; according to the condition of the atmosphere inside. If we could get them a hundred feet apart we would put them so, but sometimes two hundred feet would be possible, and obviously more convenient when possible.

Q. What was the shortest distance?

A. It ran anywhere from fifty feet up to two hundred feet.

Q. Was fifty feet the shortest distance?

A. Sometimes we would go down to twenty-five feet, but not often.

Q. Wasn't it usual to put them twenty-five feet apart?

A. I don't know but it was more usual to do that. I was only speaking of the longest, then of the compulsory coming down to shorter intervals of length when found necessary.

Q. Wasn't it the usual way to put them twenty-five feet apart?

A. Not when the atmosphere was clear, when we had a full gang at work.

Q. The inside lines of those frames represented the exterior lines of the Tunnel, or how did you fix it?

A. That was the way.

Q. The inside lines of your frames represented the exterior lines of the Tunnel?

A. No, sir. The outside line of my frame would represent the outside line of the opening.

Q. Then you would sight across the top of that?

A. Yes, sir.

Q. Would there be room enough for you to get your head above the frame, so that you could sight across?

A. You could see a light by sighting across. You know, of course, Mr. Shanly couldn't break out the Tunnel exactly to the dimensions. Then, another thing. We frequently used an offset stick. Where a portion of the rock projected into the tunnel space so as to obstruct the sight, we took an offset stick, one or two feet long, as required, and marked the rock to be removed, holding the lights at the end of the offset sticks.

Q. How did you sight?

A. By using lights.

Q. Did you use any instruments; any levels?

A. No, except to set up the pattern in its proper place. When it was set up in its proper place, it represented the certain dimensions of the Tunnel.

Q. Could you look along two hundred feet and see whether there was any projection of rock?

A. Yes, sir; when the atmosphere of the Tunnel was suitable for so long a sight, we could look across and see the light if the space was clear of obstruction; the question of distance of sighting was a question only of ability to see the lights. As to the other part of your question,—if you will imagine my present position and that of the chandelier in the room at some distance off to be at corresponding points on separate patterns set up to represent the perimeter of a tunnel, you will at once perceive that the fact of unobstructed vision, or its opposite, may give the knowledge sought for. In actual practice, the light is moved along the pattern by successive spaces of one foot only. If it can be seen at every point by an observer placing his eye in succession at the corresponding marks on the other pattern, we know the Tunnel to be large enough.

Q. Didn't you use levels, so as to be sure that you got the right direction in looking across?

A. I made sure at first that at the point selected the pattern was set up right.

Q. At any intervening space between those patterns, didn't you use levels?

A. Nothing more was necessary than to look from one point to

another point. By looking from here to the chandelier, I could tell whether the line between me and the chandelier was obstructed or not.

Q. Do you mean to say that you didn't use any other means but sighting?

A. I used a line sometimes, but this was the more general way.

Q. You used a line sometimes; what sort of a line?

A. Just stretched a line from one pattern to another.

Q. A cord?

A. A cord, I mean.

Q. I didn't know but you might have used levels?

A. No, sir. You see this was an exact way that precluded any possibility of mistake.

Q. I suppose, if there was any rock projecting at any point of the Tunnel that was inside of the section required, you could detect it?

A. Why, yes, because its projection would shut out my vision.

Q. Supposing it wasn't more than an inch?

A. I didn't look to that at all. I made a mark where it was.

Q. You could detect it, if it wasn't more than an inch?

A. O yes, sir; an inch would cut off the view. I marked everything that came in view.

Q. Marked it, how?

A. With paint. It was my record to show there was something in the way.

Q. Did you attend to this personally?

A. No, sir, only in a general way.

Q. Who did attend to it personally?

A. My various assistants over the work.

Q. The object was to find every particle of projecting rock within the area prescribed, I suppose, was it?

A. That was it.

Q. They had directions to mark every projection?

A. Yes, sir.

Q. However minute?

A. Why, certainly.

Q. If it wasn't more than half an inch, everything that projected they were to mark?

A. They would mark it.

Q. And Mr. Shanly was to be required to take it off?

A. He wouldn't take off any half inches; of course, that is unnecessary to say.

Q. Then why were they marked?

A. So that I might know where the area of the Tunnel was when I went through it.

Q. Then, did you go over it and prescribe what he should take off, and what he should not? What directions did you give him then?

A. I gave him the direction that the Tunnel—I don't know that I gave him any specific directions as to this; the directions were in the contract to make the Tunnel of a certain size.

Q. Didn't you have some discussion with him as to the extent to which this trimming was to be carried?

A. I believe he thought he had it full size.

Q. And he thought you were a little too minute in your requirements?

A. Yes, sir; possibly so.

Q. Was this a matter of consultation between you and Mr. Philbrick, as to the importance of having this thing done sharply?

A. Why, certainly.

Q. Was there any difference between you and him on this subject?

A. No, sir.

Q. Sure?

A. I don't remember any. You are catechising me over a long interval of time.

Q. Don't you remember any time when there was any difference between you and Mr. Philbrick as to this?

A. Well, my dear sir, I can't tell. Any general policy—

Q. Let me call your attention for a moment, to see if I can refresh your recollection. I find a letter of Mr. Philbrick among the documents, dated July 13, 1872, as to the trimming, complaining that nothing had been done, saying that grain cars of a larger size were now made than heretofore, and then saying as follows: "And we cannot with safety allow them to pass through the Tunnel unless *every inch* of the established form is excavated. Mr. Shanly says that Mr. Frost admits that the former has complied with all the latter's direction in regard to trimming. This seems to indicate a lack of directions, and on conversing with Mr. Frost, I am sorry to say that he don't appear to appreciate as I do the matter of urging the contractors at once, and persistently, in this particular."

A. Well, that is a question of time entirely.

Q. Do you remember any such difference between you and Mr. Philbrick as to that?

A. As to the question of time? The question of time inevitably recurs almost continually.



Q. The question of extent.

A. It was not a question of extent. It was, as I understand, entirely a question of time.

Q. "Unless every inch of the established form is excavated." It looks to me as if it was a question of extent.

A. I don't understand it so, except as far as, in his position of consulting engineer, he wished to remind me that what was undertaken to be done ought to be strictly done.

Q. I didn't know but there was a difference between you and Mr. Philbrick?

A. I don't remember any.

Q. You said, a little while ago, that of course Mr. Shanly wouldn't be required to take off a half inch of rock that was projecting, but Mr. Philbrick says in that letter he would require him to take off an inch.

Mr. TRAIN. I didn't understand Mr. Frost so. I understood it this way, that wherever his sight was obstructed, he painted, and there it had to be cut off, no matter whether it was an inch, or half an inch, or a foot. If he couldn't see through, then it was wrong.

Mr. ALLEN. I understood him to say differently. I understood him to say that of course Mr. Shanly would not be required to do such fine work as to take off half an inch. I wanted to know whether, if he would be excused from taking off half an inch, he would be required to take off an inch.

A. It would be very hard to say whether you would see a projection of half an inch; it would come so near the width of the light.

Q. Have you any doubt that you required him to take off every projecting half inch of that Tunnel, from one end to the other? As a matter of faithful engineering on your part, didn't you require that?

A. Well, I required him to make a full-size Tunnel. I can believe that in the imperfections of sighting, in going through it, there might have been a half inch omitted.

Q. But you didn't mean there should be?

A. I meant to get a full-size Tunnel.

Q. You didn't mean there should be a half inch projection from one end to the other?

A. I meant to get it full size.

Q. Did you mean that there should be a half inch of projecting rock, within the area prescribed, from one end to the other of that Tunnel?

A. The question of intention and the question of fact are sometimes slightly variant.

Q. Will you answer my question? Did you intend that there should be a half inch of projecting rock, from one end of the Tunnel to the other?

A. My intention was to get a full-size Tunnel.

Q. Did you intend to leave a single half inch of projecting rock anywhere, from one end of the Tunnel to the other?

A. There have been cases—

Q. Can't you answer my question?

A. I am waiting to answer it, as soon as you will let me. I said there had been cases in which I knew of half an inch at parts of the Tunnel not so material as others, not coming in direct contact with cars, where it had been intended to cut it full size, where Mr. Shanly had gone over it with these patterns, and had worked it, and that there were fractions of an inch, possibly amounting to half an inch.

Q. Can you tell where there was an instance of that sort? That is a matter of curiosity. If you can find such an instance, I would like to know it.

A. I couldn't identify it. It arose on the question whether Mr. Shanly should be required to go over it again.

Q. Did you make him?

A. No.

Q. Do you think there is more than one such instance in the Tunnel?

A. It is rather a narrow question, to come down to such small fractions as that.

Q. You didn't mean, as I understand it, to allow any? If there is any such place, it is by accident?

A. I mean to say this,—that Mr. Shanly contracted to make the Tunnel full size, and it was also my business to have the Tunnel full size, and I undertook to help him in this. It was his business, acting in good faith, to do it; but if there happened to be an immaterial half inch remaining, that would be a proper matter of my discretionary judgment to permit.

Q. In which part of the Tunnel did you consider a half inch of the least importance, if it happened to project?

A. In the roof centre, or bottom of the floor.

Q. Did you keep back from his estimates any moneys because of his delay in executing this trimming to your satisfaction?

A. I kept back the value.

Q. Estimated, how?

A. Estimated at a certain price per cubic yard.

Q. How much?

A. My impression is, \$40 per cubic yard.

Q. How much, in the aggregate, did you withhold from him for that consideration?

A. Well, sir, it varied from month to month, according to the amount.

Q. How much do you recollect in items?

A. I haven't the faculty of remembering figures, Mr. Allen.

Q. Did you withhold large sums?

A. Considerable sums.

Q. Thousands and thousands of dollars, at different times?

A. I should say so.

Q. A great many thousands of dollars?

A. Yes, I know that.

Q. Do you know how much this trimming cost him, that you required him to do?

A. Well, the cost was so variant, in different places, that it would be absurd to make an estimate.

Q. He has said that he thought you put him to an expense of \$110,000. What should you say to it, as an estimate?

A. I should say that I have never had occasion to give any attention to the subject. It has never been put in, as a matter of claim, and I have not examined it. I haven't any idea.

Q. You can't say that that is an excessive estimate—you haven't any opinion as to that?

A. I should prefer not to express one.

Q. You heard him testify on that subject the first day of the hearing, do you recollect it?

A. I didn't notice it; that is to say, I don't recollect it now.

Q. You got him to go through with this work of trimming?

A. He went through with it.

Q. When did he complete it?

A. Well, not very much behind the completion of the Tunnel. It went on *pari passu*.

Q. Well, when was this last minute trimming with frames required to be done, as you remember?

A. Of a very recent date.

Q. He began it in 1872?

A. Yes, sir.

Q. And continued it along through from that time?

A. Yes, sir.

Q. When was the last time that you remember to have discovered, in any part of the Tunnel,—that is, away from the immediate vicinity of the west shaft,—where there was considerable work, that was not done until the first of September,—what was the last day

that you remember, in any other part of the Tunnel than near there, where there has been any of this trimming to be done?

A. There was trimming in the central section; during the whole of 1873 there was work continually of that sort.

Q. I am asking you the last date you remember, away from the immediate vicinity of the west shaft, where there was any of this trimming to be done?

A. During the summer of 1874.

Q. What part of the summer?

A. I can't tell without my documents or some notes of reference. This work has been so much complicated as to involve a large amount of detail. I don't carry those smaller items of labor in my mind. I know there was some trimming there.

Q. Sometime in the summer of 1874?

A. Yes, sir.

Q. Do you remember what part of the Tunnel that was in?

A. I recollect some in the bottom of the Tunnel, in the bottom of the floor.

Q. I did not mean to ask the question whether in the roof or in the bottom, but I do not object to being answered in that way; it is a fair answer. What I meant to ask was, in what portion of the Tunnel, reckoned longitudinally,—whether in the east section, the central, or the west section?

A. Well, I think in the eastern division of the Tunnel.

Q. Now, after that trimming was executed to your satisfaction, so that he had got the Tunnel to the full size, according to the lines that you gave him, I want to know if you then required him to go over the work again and take out some loosened rock?

A. Yes, sir.

Q. After he had got it full size?

A. Yes.

Q. Rock that was slightly loosened?

A. Yes.

Q. Did you require him to do blasting to get it out?

A. Where it did not come out otherwise, I advised him to use blasting; I don't know that I required it.

Q. Didn't you require him to take out rock that he couldn't get out without further blasting, that would not yield to bars and wedges?

A. I advised him that rock loose and hollow was unsafe; that because it would not yield at the time to bars and wedges would not be accepted by me as evidence that it was secure.

Q. But that blasting would be required to get it down?



A. That he should not make the excuse that the men could not get it out by wedges, the excuse for leaving it there.

Q. But it must come out, even if he had to blast to do it?

A. Yes, sir.

Q. You did use the expression "blasting" to him?

A. Undoubtedly, because that was the very point; the men said they couldn't get it down with wedges and bars.

Q. This rock was rock outside of the exterior lines of the Tunnel?

A. Yes.

Q. And only slightly loosened, some of it?

A. The word "slightly"—yes, I might say so. There is so much rock remaining that is slightly loosened that I won't—

Q. I want your dealings with him, and not the present condition of the Tunnel. Did you require him to take down rock that did not threaten any danger in the present use of the Tunnel?

A. That I can't remember of.

Q. Did you require him to take down any rock that did not threaten any danger in the present use of the Tunnel or the immediate future?

A. I don't think I required him to take down any such rock. What you mean by "present use" is contractors' use. There is a large variation between contractors' use—

Q. I will leave you to construe that.

A. Then I must construe it before I speak. The public were looking for the opening of the Tunnel for the passage of trains,—that was my guidance.

Q. I find a letter from you directed to Mr. Macy, dated November 5, 1874, from which I have made an extract, and you stated in that, that your requirement was, "that Mr. Shanly should remove from the roof and sides the slightly loosened slabs or masses which, not threatening any danger in the present use of the Tunnel, would eventually impair the usual and proper security which belongs to entire completion." Do you recognize that language?

A. Very likely; yes, sir; there is just the same distinction made there which I have tried to establish more imperfectly by my words here.

Q. You recognize that language as yours?

A. I presume that I may have used that language to express the idea which I have expressed to the Committee.

Q. (By Mr. TRAIN.) "Present use" means contractors' use, and "future use" means public use.

A. Yes, sir; that is the construction I put upon it.

Q. (By Mr. ALLEN.) "Not threatening any danger in the present

use of the Tunnel." I will leave you to put any construction you please on the language, but this was written November 5, 1874?

A. Yes, sir.

Q. Well, was that your purpose in the requirements you made of Mr. Shanly, to hold him to such a measure of duty, in taking down loose rock, as is there expressed in that language which I have quoted?

A. That was a letter—

Q. Won't you answer the question? Was it your purpose to hold Mr. Shanly to such a measure of performance of duty, in taking down the loose rock, as is expressed in that language that I have quoted? Was it your purpose to hold Mr. Shanly to do that?

A. I will answer as to the purpose of the letter—

Q. No, sir, I don't ask you as to the purpose of the letter; I ask you whether it was your purpose to hold Mr. Shanly to such a measure of duty as is there expressed in taking down loose rock? Do you want to see the language again?

A. I was trying to think whether I could go back. The question is one of construction of language. I should much prefer to adhere to what I said, which was the guide of my action, rather than to try to go back a year ago and ascertain what my purpose was in writing a long and private letter to a member of the Tunnel Committee, soliciting the views of the Committee about it, and explaining the position. It was supposed to be supplemented by further verbal communications; but, as I have said, I think it expresses exactly—

Q. I want to know if you can answer me "yes" or "no,"—whether it was your purpose to hold Mr. Shanly to such a measure of duty, in taking down loose rock after the trimming had been completed which you have described, as is expressed in that language which I have quoted; can you answer that, "yes" or "no"?

A. I think my answer is better—

Q. Can you answer the question "yes" or "no." That is what I want to know. If you can't answer it "yes" or "no," say so, and I will drop it and go to something else, and see if I can find some other letters that express the same thing.

A. I have already answered very candidly, I think, that it covers the whole ground. It depends entirely upon the interpretation. That is the purpose I had, to get all the rock down that was threatening or unsafe, except where arching was requisite.

Q. Well, do you want to qualify that language? Now, you say that you did not have a purpose so fully as is there expressed.

A. I say that every person reading that language might apply a different construction to it.

Q. I am asking you what was your purpose in regard to holding Mr. Shanly?

A. My purpose was that all those points which were so loose as to involve danger should come down.

Q. Do you want to qualify that language, and say that you had a purpose that was less full and less exacting than that?

A. I don't know that it is necessary at all.

Q. Then, do you admit that that was your purpose?

A. I don't admit that any two persons will, in general terms, apply that language, unexplained, alike; I have given the purpose I had in writing it. You applied a different meaning to it in the first place from what I do.

Q. I am using your own language.

A. That is it, but you apply a different meaning in reading it from what I intended.

Q. Excuse me, I have not given any meaning to it at all.

A. Didn't the attorney-general explain what I meant? You talked about—

Q. I beg to say that I have not expressed what I thought you meant. I have accepted the language as you wrote it. I have taken your language as it stands.

A. Then I explained that "present use" means contractors' use, and future safety means that people could go through without apprehension.

Q. When you were writing on the 5th day of November, 1874, in speaking of the "present use" of the Tunnel, you meant the contractors' use, didn't you?

A. I did. That is as nearly as I remember. That is, that is my interpretation of the language.

Q. Now, I want to verify some correspondence here. Won't you look over these letters, simply to identify them? Here is a letter from Mr. Frost, May 6, 1874; and another, May 27, 1874; letter from Mr. Shanly, May 26; letters from Mr. Frost, May 26 and July 13; letter from Mr. Shanly of July 17; letter from Mr. Frost of July 30; letters from Mr. Shanly of July 31 and August 7; letters from Mr. Frost, August 18 and August 24; letter from Mr. Shanly of August 25; letters from Mr. Frost of August 26 and October 1; letters from Mr. Shanly of October 13 and October 27; letter from Mr. Frost of November 4; letter from Mr. Frost of December 1; and letter from Mr. Shanly of December 4. I will quote more or less of those letters hereafter.

Mr. TRAIN. Does the correspondence show anything else except that Mr. Frost was insisting upon the importance of getting down the loose rock?

Mr. ALLEN. Mr. Frost's letters use substantially the same language as the letter from which I have just quoted, and there is an expression of the different views entertained by Mr. Frost and Mr. Shanly.

WITNESS. I recognize all my letters.

Q. I want to ask you now as to that Farren arch. An injury was occasioned to that by the breaking of the water-bank in 1869?

A. Yes, sir, the canal bank.

Q. That canal was an artificial canal, was it not?

A. Yes, sir.

Q. Made by whom?

A. Made by the State.

Q. When?

A. Probably in 1864.

Q. Is it within your knowledge whether Mr. Farren was paid by the State for repairing that?

A. No, sir.

Q. Do you mean to say that you don't know, or that he was not?

A. He was not, to my knowledge. Mr. Farren's work with me only extended for a little over a year, and that would be all my answer.

Q. In whose care was that in 1868, while you were superintendent of the work?

A. In my care.

Q. As acting for the State?

A. Yes, sir.

Q. Now, if the State had made this canal secure, would this injury have happened from that flood at the west end?

A. The question of security is one that goes so far—it might have been made so secure that it wouldn't have happened.

Q. Well, suppose the State had made its canal secure, I want to know whether this injury would have happened to Mr. Shanly in 1869, in consequence of that flood?

A. I cannot call "secure" that which fails to hold its place. If a work fail from any cause, the failure shows it not to have been secure. I say the canal was very well adapted for the ordinary purposes. That extraordinary flood of October, 1869, broke through constructions in other places that were supposed to be wisely planned.

Q. Supposing that the State had made its canal secure, would this injury have happened to Mr. Shanly in the fall of 1869?

A. I repeat—no construction can be called secure which has failed to hold out for the purpose intended.



Q. You may give your own construction of security?

A. If it had been so as to hold, it would not have broken away.

Q. Then it was owing to the imperfection of the work that Mr. Shanly received injury?

A. I don't recognize it as an imperfection.

Q. It was owing, then, to the insecurity of the work of the State, that Mr. Shanly was damaged?

A. I don't even recognize that.

Q. Wasn't it insecure?

A. What do you mean by "insecure"? If I make plans for a certain work (as the Boston conduit was planned for a certain specific duty), and a greater pressure than anticipated be afterwards put upon it, and it breaks in consequence of this, the result would not show fault of the engineering design, or of the work of building.

Q. I am attaching your own meaning to the word "insecure." I ask you the question, understanding the word insecure as you interpret it to me, if this bank had not been constructed in an insecure manner by the State, would this injury have happened to Mr. Shanly?

A. You have driven me to an extraordinary use of the word "insecure."

Q. "Driven" you?

A. Yes, sir; by following with repeated inquiries to that final and ultimate use of the word "insecure" which is not usual. If I am driven to that use of the word "insecure," it will be thought to be an unusual one. I said that I call nothing secure that fails to hold out for the purpose intended; that is a final and ultimate meaning of the word.

Q. You volunteered that explanation of the word "insecure"; I did not suggest it; you volunteered it; now, do you want to take it back?

A. No, sir; I don't want to have anything to do with it. I say the canal was wisely planned for the purpose for which it was intended.

Q. Don't you think it would have been wiser to have made it secure?

A. If the flood of 1869 had been looked for, the work should have been made larger.

Q. Don't you think it would have been wiser for the State to have made its canal secure?

A. I can answer you—

Q. Well, answer me, "yes" or "no," if you can.

A. I can answer you, that if engineers built all their works so

that nothing possible could ever destroy them, they would sometimes incur very unreasonable expenditures.

Q. Was that canal made secure against a similar flood afterwards?

A. Yes, sir.

Q. Don't you think it would have been wiser for the State to have made it secure at the outset?

A. Wisdom is to be in view of the information—

Q. You think hindsight is better than foresight?

A. I think every man should act according to his information.

Q. I may have occasion to express the opinion hereafter that hindsight is better than foresight, in reference to some opinions which you have expressed here.

A. Yes.

Mr. TRAIN. It will be a great satisfaction to me to know that.

Q. Have you any objection to stating in frank, plain terms, whether it was not owing to the insecurity of the work done by the State that this injury was occasioned to Mr. Shanly in 1869?

A. I think it was from the want of—I think this,—that the canal had not capacity enough to carry that large flood.

Q. Well, do you think that when the State leaves its canal insecure, and by reason of the insecurity of the work of the State, the canal breaks away and injures Mr. Shanly, the State should require Mr. Shanly to bear the loss?

A. I have tried to keep clear of any expressions of opinion, because I do not think it my business.

Q. Are you willing to express an opinion on that?

A. Well, I should prefer not to, because it seems to me it is begging the premises, to a certain extent.

Q. Because you think the canal was secure?

A. I mean to say that it was built wisely, according to the previous demands of that stream.

Q. You think it was?

A. I think it was properly constructed to meet the supposed demands of that stream.

Q. You say it was built wisely; don't you think it would have been wiser to have made it secure?

A. I think it was built of sufficient size to provide for all the demands of that stream which could have been reasonably anticipated.

Q. Suppose the State made a mistake, and did not build it strong enough.

A. I said it was large enough for the preceding demands.

Q. It wasn't for that?

A. No.

Q. Suppose the State made a mistake, as it clearly did, in constructing that canal, who is to bear the loss?

A. I am not prepared to say that.

Q. You think it was not a mistake? Put it just as you like; if you say there was no mistake, I will take your opinion upon that, as an engineer, for what it is worth.

A. I say that canal was large enough to carry any preceding floods.

Q. Do you think it was wisely built?

A. Well, the question how much you are going to spend for provision against remote possibilities is one which we do not choose to meet, if we can help it.

Q. Do you think it was wisely built?

A. I find no reason to question it, according to the information of those who planned it.

Q. Then you think there was no mistake made?

A. A mistake is always due to the information that is before you.

Q. You think there was no mistake, then, if I understand your reasoning?

A. The proof afterwards has shown there was danger of a flood altogether greater than ever before.

Q. Do you think that shows there was a mistake?

A. No, sir.

Q. You don't?

A. No.

Q. That there was no mistake made in the construction of that canal?

A. The question whether there was a mistake of original design depends upon whether there was anything in the record of preceding floods that indicated the possibility of such a visitation as occurred in October, 1869.

Q. Did you have anything to do with the construction of that canal?

A. No, sir; not with the construction of the original canal.

Q. It is made larger now?

A. Yes, sir.

Q. Made secure, is it not?

A. I think so.

Q. I have a letter of yours to the Messrs. Shanly, dated March 8, 1875, as follows: "Please find enclosed your diagram showing dimensions and area of excavation of rock Tunnel. I have drawn on it the lines O. P., and the lines A. P., completing the true floor of the Tunnel, and have given beneath on it also, in pencil, the true

areas, making up 432,446 cubic feet, equal to 16,017 cubic yards per lineal feet of Tunnel. Inasmuch as you have already on your printed schedule in the computation employed the area 16,015 cubic yards per lineal feet furnished you by Laurie, I apprehend that you will find it convenient to let that amount stand as being sufficiently exact for your present purpose." You wrote this?

A. I wrote that; that is the very letter I wrote.

Q. You found that the true areas would make a slight fraction in the quantity per lineal feet more than Mr. Shanly had measured, did you?

A. Than he had stated, yes.

Q. Two one-thousandths more.

A. That is it, yes. That is a good deal more than it would have measured according to his diagram. But I corrected the diagram, showing that the actual and final area of the Tunnel was that amount which I stated there.

Q. You corrected that diagram which you had sent to him before?

A. No, I corrected the diagram which he had incorrectly drawn. I had, at his request, previously sent him a section of the Tunnel, from which he undertook to copy in making his diagram. The section of the Tunnel which I sent to Mr. Shanly was correctly drawn, but there had been an omission to record one of the necessary dimensions. By this omission Mr. Shanly, not noticing very carefully the lines of my section, was led to make the erroneous diagram to which my letter relates, and the short computation which led him once to propose the withdrawing of that item from his claim on the supposition that he had claimed too much; but I found on revising his diagram that he had not claimed too much.

Q. Not quite enough, had he?

A. Not quite enough; but the difference was so slight, that I supposed he would prefer to let it stand.

Q. That left the amount, \$22,000 of work, in excess of your estimated quantities?

A. In the one item of "Tunnel not opened"?

Q. It would leave the amount of work that he did in excess of the amount of your estimates, \$22,000, would it not?

A. Yes, sir, in that item?

Q. Did you furnish a statement to Mr. Laurie to this effect, that the original measurements were not large enough?

A. I did.

Q. When?

A. Well, probably in 1869.

Q. You have read the communications of Mr. Laurie that have been in print, I suppose?



A. Yes, sir.

Q. Mr. Laurie, on page 32 and page 44 of that document,—the principal one of those documents which you furnished,—makes a statement of that fact, showing that there was this difference in the estimated quantities?

A. Yes, sir.

Q. You did tell him, at that time, or send word to him, that the amount of rock to be excavated would exceed the estimates?

A. Of course I told him.

Q. In writing?

A. I gave it to him in writing.

Q. And you told him, also, that there was loose rock to be removed, that was not included in the estimates?

A. Yes, sir.

Q. You told him that?

A. I told him that.

Q. Four or five thousand cubic yards?

A. Something like that, perhaps.

Q. Have you got copies of those statements to Mr. Laurie?

A. I probably have, in my office. I didn't think to bring them, because my calculations then—well, substantially, it does not affect my present calculation. The paper I gave him embraced the whole length of the Tunnel.

Q. It was conjectural?

A. It was an estimate, at best, as to the remainder.

Q. When you gave him this estimate, embracing the whole length of the Tunnel, did you give him an estimate for the whole length of the Tunnel, less by this amount which was stated, of cubic yards of solid rock, and also of loose rock, than what had been included in your estimates?

A. My impression now is, that the statement I gave Mr. Laurie was something of the same nature as the statement I think I read here; that when the work was completed, it would not show as many yards in the total, from end to end of the Tunnel, as my estimate of December, 1868.

Q. You think you gave that to Mr. Laurie?

A. Yes, sir; I feel quite sure I did.

Q. He did not mention any such thing in his reports?

A. No, sir; he didn't want to mention that; he wanted to make trouble.

Q. Will you furnish a copy of these communications to Mr. Laurie?

A. I will do so, unless they have been accidentally destroyed. I put them away in my files, and undoubtedly they are there.

Q. Was the original quantity you calculated done under a misapprehension, in any way?

A. No, sir; O, I should say to that (I know now what you mean), as regards that distance, yes.

Q. As to the area?

A. Yes, sir, as to the area.

Q. There was a misapprehension?

A. Yes, sir.

Q. How did that happen to arise?

A. I had an assistant that I supposed competent to make these minute calculations. The estimates I was required to make included a large amount of quantities necessarily conjectural; that is, from the west shaft westward. The variations, which were all of judgment there, were so large that I confined myself simply to general tests.

Q. What was this misapprehension under which those calculations were made?

A. The results which this man obtained are very nearly the same as Mr. Shanly furnished at the first hearing, when he proposed to withdraw this item of his claim. I infer, therefore, that he may have made an error in the same way.

Q. Did you not look over it, to see if it was right?

A. I looked over it to see that he was approximately right, but when it came to these small decimals, it would require an amount of revision which I had not time to go through with.

Q. Couldn't you have done it in a day or two?

A. I hadn't a day or two to spare, at that time.

Q. You could have done it in a day or two?

A. Certainly; I applied general tests to make myself sure that the total quantities estimated for the contract should be sufficient.

Q. Who was the young man who made that mistake?

A. His name I can't remember; it was not a young man; I remember his appearance, and all about him, and his history, but I don't remember his name. I can find his name, undoubtedly, from the records, and give it to you.

Q. It was his blunder, was it?

A. It was.

Q. Now, you say that you reported to Mr. Laurie, as I understand you, that on the whole length of the Tunnel there was no excess in your estimates?

A. I made simply a computation—

Q. Answer me, "yes" or "no;" did you report to Mr. Laurie that?

A. I didn't give him any report.

Q. Did you show any figures to Mr. Laurie, showing, on the

total length of the Tunnel, that there was no excess in the amount to be excavated above your estimates?

A. I was telling you; I am speaking from recollection as to something that occurred six years ago, and you see that I do not carry the figures, even of last year, in my head.

Q. If you don't recollect, say so, but don't make a speech; you don't recollect—is that it?

A. I don't distinctly remember, as to the amount; I only state impressions; you can have the figures.

Mr. ALLEN. That is what I want.

Q. If your report to Mr. Laurie did show that the total amount to be excavated in the whole length of the Tunnel was more than the amount of your estimates—

WITNESS. Was less.

Mr. ALLEN. Was more; then it was wrong, was it?

WITNESS. You are separating the items from the total.

Mr. ALLEN. Now, I am asking you about the total; just answer my question?

A. Then, when you speak of the total length of the Tunnel, I will answer you as to the total length. My impression is, that my estimate given to Mr. Laurie was a less number of total yards of Tunnel excavation than the estimate by which Mr. Shanly prepared the contract. I only speak from impression, however.

Q. If you have ever said heretofore that the total amount to be excavated was more than the estimates, you were wrong, whoever you said it to, were you?

A. It depends upon how the question was asked.

Q. If you ever said that the total amount to be excavated was more than the estimates, were you wrong?

A. Unless you place it so as to be positive—you have made it so you can make two questions out of one. If you will ask the question whether the quantities that Mr. Shanly excavated were less or more than estimated, I can answer you.

Q. I will ask you, if you ever said heretofore that the total amount to be excavated was more than your estimates, whether you were wrong?

A. What I have said at any time from the commencement of Mr. Shanly's work, in 1869, up to the time when he finally completed and I measured up what he had done, was of course simply a matter of estimate, based upon certain conditions of computation. What estimates I have made in all those six years, I won't undertake to say. There was one time when we apprehended a considerable amount of excavation for arching. I may have added in that excavation, and it may have been shown then, that if Mr. Shanly

was compelled to do that arching, he would be obliged to do a great deal more work than his original estimate of 1869 called for. Possibly I may have made up once a statement, in obedience to a request or instructions, but the fact remains, as I said before, that the total number of yards which Mr. Shanly did move in the Tunnel was less than the number of yards which I estimated in 1869.

*Q.* When did you discover this last error that you mentioned here the other day?

*A.* Which error?

*Q.* The error of showing that in point of fact Mr. Shanly did not excavate so much as your estimates?

*Mr. TRAIN.* That is not an error; it is a fact.

*A.* It is a mistake of Mr. Shanly's, that is all.

*Q.* When did you discover that error?

*A.* Mr. Shanly's mistake?

*Q.* Whosever error it was, when did you discover it?

*A.* It was when he proposed to amend his original petition. He had put in his original petition, and then proposed to amend it by withdrawing a certain amount from it, and I was astonished, because I thought his original petition was right, or nearly right, in its statement of quantity. I asked him to let me see the paper, and he handed it to me, and I went up and compared it, and satisfied myself that my previous figures were right.

*Q.* What previous figures?

*A.* The figures in my office.

[Adjourned to ten o'clock, Wednesday.]

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WEDNESDAY, March 17, 1875.

CROSS-EXAMINATION OF MR. FROST—*Continued.*

*Q.* (By MR. ALLEN.) That error that you speak of in the estimated amount of solid-rock excavation by which the Messrs. Shanly were required to excavate a greater amount than your estimates, was an error by one of your subordinates, I understand?

*A.* Yes, sir, which I took and therefore assumed the responsibility of.

*Q.* Have you been able to think of his name?

*A.* I think it is Williston; I depend upon recollection; this is a matter of some years ago, but I believe the name correctly given now.

*Q.* It was simply, if I understand the matter right, an error in mathematics?



A. No, sir, I apprehend that it was a simply a somewhat small error of diagram, similar to that into which Mr. Shanly fell later.

Q. Into which you *led* Mr. Shanly you mean, by giving him an incorrect diagram?

A. Well, sir, I “led” him into it by giving him an incomplete, not an *incorrect* diagram. There was a trifling mistake in one of the figures showing the warp line which represented the floor of the Tunnel. It shows how a trifling difference may become important when extended over a long distance.

Q. It made \$22,000 difference in the work on the whole Tunnel?

A. Precisely; that shows what an effect a slight decimal will have when extended over miles of distance, as happened in that case.

Q. Can you account for Mr. Williston having that incomplete diagram?

A. Not very well; no, sir.

Q. Whose fault was that?

A. I did not suppose he had an incomplete diagram.

Q. Then how did he happen to make the mistake?

A. I think he simply overlooked it in making his computation.

Q. It was a pure blunder?

A. A pure oversight is what I should presume was the case. It appears from Mr. Shanly's diagram, in which I have really exaggerated the warp line which represents the floor.

Q. Still it makes a difference of \$22,000?

A. Well, it makes a difference of a very small decimal upon a single computation, but it was extended over miles of distance, and therefore became large; but this difference became very trifling as compared with the very large quantities with which we were dealing.

Q. But it makes a difference of \$22,000 to Mr. Shanly?

A. I mean it is very slight in the percentage of the whole. In these large estimates, covering four or five millions of dollars, many of the data and conditions could only be approximately determined in advance. I felt the greater responsibility in the general questions to be established, and in the general determination of the amount required, and I had really not the time to devote to any exact mathematical accuracy, or minute relative computation, in the different details; but, applied to such a large amount, a difference of half of one per cent. becomes a considerable sum.

Q. It was  $\frac{22}{1000}$  of a cubic yard per lineal foot, wasn't it?

A. Yes, sir.

Q. That was it, exactly?

A. Yes, sir.

Q. How did that error happen not to be detected by yourself?

A. Because the computation of total quantities in the Tunnel involved so much that was conjectural,—that is, that was matter of assumption,—it wasn't possible to make the exact computation. I had to assume certain data of computation, and in going over those computations I satisfied myself of the general accuracy, so to speak ; that is, that the total quantities produced total results approaching very nearly what I knew to be the fact.

Q. But, Mr. Frost, was this not an error in ascertaining the number of cubic yards to the lineal foot?

A. Yes, I was explaining the method of tests which I must necessarily adopt.

Q. That is a matter of pure mathematics, isn't it? On a Tunnel of a prescribed form, to find what will be the quantity of solid-rock excavation per lineal foot, is a matter of pure mathematics, is it not?

A. Yes.

Q. There was a mistake of  $\frac{22}{1000}$  of a cubic yard per lineal foot?

A. Yes.

Q. How did it happen that you did not discover that?

A. In my review of the estimates, I did not necessarily go with painful accuracy into the details. Undoubtedly, Mr. Williston's computation was checked by another assistant, and was found correct, on the principles of the estimates.

Q. Then it was a blunder of two assistants instead of the blunder of one?

A. No, sir ; I think it was only a question of the position of this warp line of floor of Tunnel.

Q. How long would it take, having an area prescribed exactly, to ascertain, as a mathematical computation, the number of cubic yards to be excavated per lineal foot?

A. Well, it would be only a few hours at most.

Q. How many hours?

A. Well, sir, a few hours.

Q. You could do it in a day, couldn't you?

A. Certainly.

Q. But you did not do it in this instance?

A. I did make the general tests, which gave—

Q. I mean, you did not ascertain the number of cubic yards per lineal foot?

A. Not personally.

Q. You would not have been apt to fall into such a mistake as that, if you had done it yourself?

A. No, sir.

Q. It is a matter there can be no mistake about, I suppose, with one who is competent to do it?

A. The data assumed, the answer must come, as in the case of Mr. Shanly's estimate and mine; I detected the difference at once.

Q. It is a matter of pure mathematics; forty competent men trying it would reach identically the same result?

A. If they took the same assumptions to begin with.

Q. For the same area?

A. Yes, sir.

Q. Now, you say this error compelled the Messrs. Shanly to do work which was not expected at the time of their making their contracts, to the amount of \$22,000, and you find there has been also another error which offsets that, and more too?

A. No, sir; I mean to say that my estimates were, necessarily, made upon certain assumed conditions; one of these, for example, is the assuming that a certain length of Tunnel would require a certain thickness of arching. I had the figures of estimate made upon such conditions as I prescribed. All estimates for any work have to be thus made, unless the whole of the conditions for its construction can be fixed in advance, and in this case some were not certain.

Q. In reference to all that portion of the Tunnel where no excavation had been made, of course, there was not any room for any mistake as to that?

A. No; that was a positive thing. The data were given, and should not, that is, would not, be varied. I have answered your question, if I understand its meaning.

Q. Then, when you think you find he has not done so much work in other respects as was expected at the time of entering into the contract, you do not refer to any portion of the Tunnel where the work of excavation at that time had not been begun?

A. Certainly not; I refer to the whole. I take in the whole Tunnel, from portal to portal, when I make my statement.

Q. I want you to give me the details to show how you arrived at the result, that, on the whole, he has not excavated as much rock, from portal to portal, as was expected. I understand that to be the statement you make,—that, on the whole, he has not excavated as much rock as was expected?

A. That is, the final estimates, made under the contract, show less quantities than my original computations.

Q. Now, if that could not be in any of that portion where the Tunnel was untouched at the time when he began, I want you to explain where it was, and how?

A. I divide the Tunnel into three divisions: first, the division that the State had opened from the east portal; second, the unpenetrated mass of rock; and, third, the distance at the west end

through which the State had opened drifts of greater or less size. In the first division, there was no room for material change; in the second division, this difference which you have now held up occurred; the third was the portion as to which it was not possible at that time to say exactly what dimensions would be appropriate. It depended, in part, upon the thickness of the arching which it should be found proper to make in order to support the rock, and also upon the question whether an invert, or support, beneath, would be needed. All these things being held to be undeterminate at the time I made up my original estimate, I represented it as an approximate computation of quantities, which I believed amply sufficient for the length of the Tunnel to which they applied. I thought this to be the proper course.

Q. Now, won't you give us those figures, so as to show exactly; I want to see exactly, down to a dollar, how you got at that.

A. Here is the paper from which I read yesterday, and I am able to give the figures from that; they are as follows—

Q. Just show me what the advantage was to him; that is what I want; in which division. I want the details showing which of the estimates were above what he actually did.

A. I have divided it into three divisions; I made the divisions into the part opened on the east side, which was opened by the State; the part not yet penetrated; the part on the west side that had been opened by the State.

Mr. ALLEN. The part not penetrated could not, of course, come into this?

Mr. TRAIN. Yes it could.

A. It was a comparison of my estimate with the work he did, as found upon the final estimate. In the eastern section—that is, in the eastern portion opened—my original estimate was 32,500 yards; the work which he actually did, on final computation, makes up 32,431 yards, with the addition of loose rock, which might be called one-eighth value; 3,577 yards, divided by 8, will make the proper proportion of value to be used—447 yards additional. Then, going into the portion of the Tunnel yet unpenetrated (that is what constitutes part of Mr. Shanly's claim), the original estimate was of 250,310 yards; the actual quantity taken out by Mr. Shanly, by the final computation, was 252,224. Then, going to the west end of the Tunnel, my original estimate was 52,800 yards. The quantities, by final estimate, 48,685 yards, less in this case the loose rock he did not take out, 412 yards, divided by 8, taking the same proportion. In the second division, I omitted to note 434 yards loose rock left in the Tunnel; there is 434, divided by 8, to be subtracted from his quantities taken out.



Q. That would make 54 cubic yards?

A. Yes, sir; this is only an approximation, in order to make the totals in amounts equivalents.

Q. Now I notice that the whole of the advantage which you say he got was in the west-end section?

A. Yes, substantially.

Q. Do you mean to say that there is any portion of the east-end section where he did not make the excavation to the full size required by the contract?

A. Well, sir, the contract—

Q. Can you answer that question?

A. I must answer it properly. The contract makes it my duty to prescribe the size of the Tunnel where it could not be defined beforehand, as in the case of the arching; consequently, the directions that I have from time to time given prescribe the size of the Tunnel there. That size he has taken out.

Q. All the sizes you have prescribed?

A. Yes, sir.

Q. Have you in any instance prescribed any less than the area which prevails through the central section and the east section?

A. No.

Q. You haven't?

A. No.

Q. So that it leaves it, then, to rest entirely upon that portion of the Tunnel where arching was required, does it not?

A. Yes, substantially.

Q. That is to say, that in the excavation for arching there has not been as much prescribed for him to do as you originally estimated, is that so?

A. That is the fact.

Q. Can you tell me how you got at that 52,800 yards which was the amount of your original estimate in the west-end section?

A. I cannot here; probably by going up and looking over my papers of that time I could find the very figures.

Q. Does that depend upon the estimate which you then made of how much arching would be required?

A. Yes, sir; I made an approximate estimate.

Q. When you arrived at the result of 52,800 cubic yards to be excavated in the west-end section, you made an estimate, if I understand you, of the length of Tunnel that would probably require arching?

A. That was never expressed in any document or record; and purposely not, because the quantity of brick was made the standard, in place of length, in the contract.

Q. You did make an estimate, I suppose, of it yourself, in order to get at that 52,800 yards?

A. I did.

Q. You must have done so, must you not?

A. I must have done so.

Q. Do you remember how large that length was?

A. My impression is that I estimated up to and covering the west shaft.

Q. More than enough to use four and a half millions of brick?

A. That was just where the element of uncertainty entered. That is, it was not at all possible to say just where the arching would be requisite, so as to define it at that time. We had not had the Tunnel opened long enough to determine exactly. I only applied it to the length of Tunnel opened—that we should require about so much arching work, and being thus indefinite as to the exact length, the quantity of bricks was substituted instead.

Q. Four and a half millions?

A. Yes.

Q. That was the amount that was mentioned as the limit of the amount of brick for the west end section that he should be called upon to lay under the contract?

A. Yes.

Q. You say you did estimate, in making your figures, the length of the Tunnel in that section that would probably require to be arched; you did put it down in figures?

A. I never put it down in figures that were preserved as part of my records.

Q. No; but you did make the estimate?

A. I must have used some figures, of course, in estimating.

Q. And you must have estimated the length of the Tunnel which would require to be arched?

A. Yes.

Q. Now, I want to know whether, when you made that estimate of the length of the Tunnel that would probably require to be arched, you estimated a greater length than what  $4\frac{1}{2}$  millions of brick would be sufficient for?

A. That is just where you come back again to the same point.

Q. Can you answer the question, "yes" or "no"?

A. No; because if you make the arch  $2\frac{1}{2}$  feet thick it will obviously take more brick per running foot than if you make it 20 inches thick. That is just the impossibility of giving the length.

MR. ALLEN. We can see that, even simple we, as we sit here.

WITNESS. You asked the question, and I answered it.

Q. Do you recollect how much you did estimate would be arched?

A. If you ask my impression, in making up my figures (this estimate was never presented)—but my impression is that it was not exceeding 2,500 feet.

Q. Did you require him to do arching sufficient to use up the entire amount,  $4\frac{1}{2}$  millions, of bricks?

A. Well, very nearly; yes, sir.

Q. Did he do it?

A. He did, substantially.

Q. How many bricks were there used?

A. I made a general computation of the length of Tunnel; I wanted more arching than his contract would cover; consequently I made a computation making up what I thought he was fairly required to make by his contract.

Q. Four and a half millions of bricks?

A. Yes.

Q. You estimated as accurately as you could, and then called upon him to do that length?

A. That was about the way in which I arranged it. It was not that amount exactly.

Q. You made it just as nearly as you could estimate it, didn't you?

A. That was what I intended to do.

Q. And he did that?

A. Yes.

Q. Then the engineers called upon him to do a large amount of arching after that, didn't they?

A. Yes, while he was still at work on that.

Q. They called upon him to do a large amount in excess of the  $4\frac{1}{2}$  millions?

A. Yes.

Q. And he came to the legislature and had a hearing at the last session, and there was an Act passed which relieved him from doing that?

A. Yes.

Q. But at any rate you gave out to him then an excavation of sufficient size and of a sufficient length to use up  $4\frac{1}{2}$  millions of brick?

A. Very nearly that quantity.

Q. Well, how much short; you keep saying "very nearly"?

A. I haven't the figures.

Q. Do you think it was 25 bricks short?

A. I cannot tell which way the balance stood; it was a little short, if I recollect rightly.

Q. Why do you say you cannot recollect which way the balance stood?

A. Because I haven't had a chance to compute it again. It was decided to accept the Tunnel. His contract, as made, shows him obliged to lay not exceeding  $4\frac{1}{2}$  millions of brick, and I decided what length of arching should be required of him under that clause, and that length of arching was built.

Q. You hit as near to that amount,  $4\frac{1}{2}$  millions, as you could?

A. In advance.

Q. Are you prepared to say, to-day, that he fell short 25 bricks of that  $4\frac{1}{2}$  millions?

A. Well, sir, here is the question that comes in, and which I will show—

Q. Can't you answer the question?

A. No, sir; I will tell you why.

Q. Can you answer the question? I am simply asking your knowledge.

A. I am prepared to give my knowledge.

Q. Are you prepared to say that he fell short of the  $4\frac{1}{2}$  millions of bricks, 25 bricks?

A. I am not prepared to say anything about it; and I am prepared to tell you why, if you wish to know.

Q. I don't care anything about the *why*, all I want is the fact. This 48,685 yards that you say he actually excavated in the west-end section was got at, how?

A. By the measurement of the dimensions prescribed for him; that is to say, the dimensions prescribed for him were entered in my books.

Q. Is that limited to that portion of the Tunnel where arching was required of him, or not?

A. No.

Q. Is it limited to that portion of the west end of the Tunnel which at the time of the commencement of his contract had been partially opened?

A. Yes.

Q. Then, does that estimate require an exact computation of what had been excavated at the time when he began the work?

A. It does, necessarily.

Q. Have you got the minutes of that?

A. I have at my office, not necessarily here, for they are very voluminous indeed.

Q. If this estimate of 48,685 cubic yards is limited to the section of the Tunnel which was already partially opened, it would require an exact knowledge of the amount which had already been taken out?

A. Yes.



Q. Now, I want to know if you have got those minutes anywhere in such condition that they can be verified by Mr. Shanly?

A. Yes.

Q. How can he verify them?

A. He can verify them by computing at each 25 feet distance, or less. He will find on my records the measurement showing the shape of the Tunnel when he undertook it.

Q. Did you take it every 25 feet?

A. Yes.

Q. Is that near enough? How would anyone know what was the excavation between those distances of 25 feet?

A. Wherever there were irregularities of any very great note, I took the intermediate points; when I say 25 feet, I speak of that as the general average between the sections taken.

Q. Well, the Tunnel is irregular all the way through, is it not?

A. Yes.

Q. It could not be excavated to an exact line by blasting?

A. No.

Q. The diagrams show great roughness?

A. The only thing that can be said regarding all field-work is, that there is as much given on one side as another, if a careful record is taken of exceptional parts.

Q. Is there any way under heaven of verifying your measurements of the excavation actually done? Is there any possible way that anybody in the world can now verify your estimates and determine whether they were right or not?

A. I have got them all recorded in my note-books; that at each point it measures such height or width.

Q. Is not, after all, the amount of excavation to some extent a matter of judgment, and not of measurement?

A. No.

Q. The amount of excavation that had been made when he commenced his work?

A. No.

Q. You have made sections once every 25 feet?

A. Yes.

Q. Or once every 10 feet?

A. Well, measurements were sometimes made between those stations. The assumption is upon the reasonable probability that whereas in one case I shall give him a little more, from giving him the projecting points between those measures, in another case I shall give him a little less.

Q. Then it is a matter of judgment when you give him a little more or a little less?

A. Not when you take this regular standard as to distance between measurements.

Q. When you are measuring how much is taken out, it is a matter of judgment to some extent, isn't it?

A. I don't think it so, except it might be so far a matter of judgment or agreement how far apart these sections ought to be taken to get the average.

Q. That is a matter of mere judgment?

A. To that extent.

Q. Is there any living man who could take that Tunnel as it is now, and tell, in three years' time, the exact number of cubic yards of excavation?

A. It would involve a great deal of work; yet, when he got through, he would probably obtain very nearly the same amounts as I have, following the same dimensions.

Q. When did you first ascertain that there was this difference between 52,800 and 48,685 yards?

A. I cannot tell you. An approximation would have been ascertained many months ago, because he had got pretty near the completion of his work, and I knew about how much he had done.

Q. There was a difference of over 4,000 cubic yards?

A. Yes.

Q. When did you ascertain that?

A. I knew it was going to be about that amount in November or December last; that is, I knew in a general way that it was going to be about that amount less than the estimates.

Q. When did you make it up nicely?

A. During the month of January.

Q. What time in January?

A. Well, sir, the work was commenced in December; I should say, during the months of December and January, more properly.

Q. To whom did you first tell that?

A. I don't believe that I have ever told it to anybody. I made an approximate statement, as I remember, which the governor and council had in December.

Q. Showing this difference?

A. Substantially, yes; probably not exactly the same.

Q. Did you call their attention to the fact that the amount of his excavation was less than the estimates?

A. It showed it on its face, and undoubtedly that was part of the information I gave them.

Q. Was it in writing?

A. I don't know whether it was presented in writing or not; I should have to refer to my memoranda to ascertain. Their discus-

sion was on general principles of allowance, and it is quite probable that my statement was made verbally only.

Q. Who was present?

A. I should have to make the same answer that I did yesterday, that the statement must have been made to members of the Tunnel committee, and that it would be impossible to tell in regard to any particular incident, which members were present on that occasion, which was one of several in which the matter was considered.

Q. Well, can you give the name of anyone who was present? Do you know whether the governor was present?

A. Whether he was present at the interview or not, I cannot, of course, say now, from recollection.

Q. Do you recollect calling their attention distinctly to that fact, that in the west-end section the amount of excavation had been less than your original estimates?

A. Well, even that would be a matter that I cannot distinctly recollect, whether they took pains to go into the minor details of it.

Q. Did you state that to them?

A. I cannot say that I did.

Q. I was asking you when you first told this, and I think you said you made the statement to the governor and council?

A. No, the total result.

Q. Did you state the total result to them?

A. Yes, sir.

Q. And that was in December?

A. Yes, sir.

Q. Was the governor present then?

A. That is what I am unable to say. I have supposed that anything said to the Tunnel committee was, by that fact, known to the Tunnel committee.

Q. Won't you see if my computations are right? In the first place, your original estimate was 32,500 yards in the east section; 250,310 in the central unpenetrated portion; 52,800 in the west section; and I make the total amount 335,610 yards as your estimate; is that right?

A. That is right, sir.

Q. Now, the work actually done, as I make it, in the east portion, was, according to your estimate, 32,878 yards, including 447 yards of loose rock?

A. I have aggregated the loose rock, and divided by 8, in the total.

Q. Then the next portion is 252,224 yards, deducting 54, making 252,170; and your next is 48,685, less 52, making 48,633. Adding

these, I make the total 333,681. Let me ask you, in that west-end section, if that 412 is to be added or deducted?

A. That is to be deducted.

Q. That is to say, you give Mr. Shanly the benefit of that?

A. He did not take out so many yards as he should by leaving that amount.

Q. By leaving 412 yards?

A. Yes.

Q. That makes it 333,681 cubic yards, on that basis, don't it?

A. That is right.

Q. The difference between that and your estimated quantity is 1,879 cubic yards, is it not?

A. My estimated quantity was 335,610 yards.

Q. That is what you say he did, 333,681 yards?

A. That is right.

Q. And the difference is 1,929 cubic yards?

A. That is right.

Q. When you were estimating how much benefit Mr. Shanly received from not doing the work you expected him to do, how much did you allow per cubic yard for that?

A. I made, so far as I remember, no allowance per cubic yard.

Q. You gave us yesterday some figures which showed that he had not done the amount of work, within \$78,500, that was expected?

A. Yes, sir.

Q. Now, I want to know how much you allowed for this in making up the \$78,000 difference?

A. I brought a statement here which you evidently do not comprehend. It is all here in black and white, just transcribed from the final estimate, made up according to the provisions of the contract.

Mr. TRAIN. Make him comprehend it, can't you?

WITNESS. He cannot help reading it, and that will be comprehension.

Q. The difference is 1,929 cubic yards?

A. That is true. I will make an explanation, if you want to have it explained.

Mr. ALLEN. I want to understand it, if I am capable of doing it.

Mr. TRAIN. Assume that he is, and go on.

A. The explanation is simply as to the method of working the Tunnel. In my original estimates, I estimated for a certain length of rock in the central section lifted from the shaft, which would be very expensive.

Q. I want to know how you make that 1,929 cubic yards cost \$78,000?



A. I never did make that statement, or anything that looks like it.

Q. How did you make that \$78,000 difference?

A. That is the same paper which I presented yesterday, which I can read in detail.

Q. You make the difference in yards 1,929?

A. Yes, sir.

Q. And it is on that difference that you make \$78,500?

A. Not at all.

Q. What was it?

A. It is due to the fact that a great deal of the material which was originally estimated to be lifted out of the central shaft was taken out at the end, costing much less per cubic yard.

Q. That element enters into it,—the manner of doing the work; that, instead of being hoisted out of the shaft, it was taken out at the end. How much did you allow for that?

A. The contract prescribes how I shall estimate, and I estimated according to the words of the contract.

Q. That is to say, when you are undertaking to say how Mr. Shanly stands in regard to this work, if there is a cheap way of doing the work and a costly way, you will expect him to do it in the most expensive way?

A. No, sir.

Q. If he can do it in a cheaper way than you estimated, you do not give him the benefit of it?

A. I have no discretion in the matter; the contract prescribes how I shall act.

Q. Now, Mr. Frost, in regard to the figures you made in estimating. You referred yesterday to some statements that you made to Mr. Laurie. Of course, this error that you say was beneficial to Mr. Shanly, you never mentioned to Mr. Laurie, because it had not occurred at that time?

A. I made it known to him that this change was going to occur. I had begun to discover it at that time.

Q. Even before Mr. Laurie went out of office?

A. Yes, sir.

Q. Now, I see, that, in a communication of Mr. Laurie of July 15, 1870, addressed to the governor, which is printed in this document of 1871 (Senate Document, No. 283, page 44), there is a statement which I would like to have you give your explanation of:—  
“At a meeting of the governor and council, held April 6, Mr. Frost stated that there was a large amount of loose rock within the lines of the Tunnel which had been omitted, unknown to the contractors in making up the schedule of the quantities; also, that the quantities

of solid rock, under a misapprehension, were calculated at less than the actual sectional area of the Tunnel, and that he had destroyed the original notes and estimates on which the schedules and quantities were based, to prevent the contractors from making or establishing any claim for the work so omitted."

A. This, like some of Mr. Laurie's angry statements, is absolutely false, so far as it refers to my concealing anything regarding the operations of my work.

Q. So far as the misapprehension in making up the schedule quantities is concerned, I suppose it is correct, isn't it?

A. I had given him the same information which I gave you to-day,—exactly the same.

Q. There was a misapprehension by which an error of  $\frac{22}{1000}$  of a cubic yard for each lineal foot was made, and that you had communicated to him?

A. Why, certainly ; yes, sir.

Q. And I suppose that that portion of his statement is correct?

A. That is correct ; I speak as to the latter part.

Q. That latter part, where he says that you stated to the governor and council that you had destroyed your original notes and estimates on which the schedule quantities were based,—how is it about that?

A. I think that is certainly false.

Q. Did you ever destroy these original notes and estimates?

A. Not consciously,—that is to say, I have no recollection of such destruction, or of any object in such destruction. It was rather my purpose to preserve all the papers that I had.

Q. Do you remember whether you did destroy those original notes or not?

A. No, sir.

Q. You don't know whether you have them now or not?

A. I should not be able to tell unless I made a search. You see, they have no value, except so far as they are records on file. The result was recorded.

Q. Recorded where?

A. In this schedule which Mr. Shanly carries, which has been discussed again and again.

Q. When did it first come to your knowledge that Mr. Laurie had written this letter or report?

A. Well, I will state, in general terms, that I think the council at that time rather inclined to withhold from me the knowledge of this angry statement. They were afraid that I might get into a quarrel with Mr. Laurie, and that it might do harm to the work.

Q. You did ultimately have a dispute with him?

A. The dispute had originated before this time. These angry statements grew entirely out of my refusal to be dictated to by him in regard to the policy I pursued.

Q. Without going into the details of that, there was a controversy existing between you and Mr. Laurie, which extended over, how long a time?

A. It commenced after he had been consulting engineer about six months, and was just beginning to find out something about the work.

Q. He began in May, 1869?

A. He commenced about May, 1869. The contracts had been in operation several months.

Q. He was there from about May, 1869, if I carry the dates rightly in my mind, until about January, 1871?

A. That is right, sir.

Q. And your controversy began about six months after he went there?

A. About six months after he came into power.

Q. And continued until he left?

A. In various forms; successive ones; devices of his.

Q. When did it first come to your knowledge that he had made this report?

A. I attached so little importance to it, that I cannot tell.

Q. As nearly as you remember?

A. I haven't the slightest idea, unless I refer to my records.

Q. It was a pretty grave matter?

A. My dear sir, it had been discovered long ago that his words were not worth noticing.

Q. Had it?

A. Yes, sir.

Q. How soon had that been discovered?

A. This controversy had been carried on for many months, when this hearing before the governor and council occurred,—a grave controversy, extending over six months, in which he had told me that my views of the subject led to the suspicion of collusion with the contractors as one of the reasons why I should adopt his views. I came down to the council meeting expecting to discuss nothing else but that grave matter, with which a few members of the Tunnel committee were conversant, as to our difference of views. It was never mentioned in the council meeting at all! He brought up a lot of petty details, which were contemptible.

Mr. TRAIN. You do not make any equitable claim on account of this controversy, do you?

Mr. ALLEN. Well, I don't know.

WITNESS. I want to state it fairly ; it was a very trying thing to me at the time.

Mr. ALLEN. I want you to have every opportunity to explain ; it is a very grave matter.

Q. My question still comes back, when did it first come to your knowledge that Mr. Laurie had made this charge against you?

A. My dear sir, he was so fertile—

Q. Just answer my question.

A. I cannot tell you. He invented so many schemes, and showed so plainly that he wasn't worthy of confidence, that I really do not recollect when ; I should have to look over the record.

Mr. ALLEN. That is the gravest one I have met with myself. Do you remember any other as grave as that?

A. There were some things very much more trying to me than that. I could afford to disregard that.

Q. Did he make any worse charge against you than that?

A. I mean to say, that he made others that were more trying to me, because I could not disprove them. I could disprove that, and it did not disturb me. When he said I was not running the lines right, I could not disprove that, and it disturbed me. I knew that my lines were right, but I could not prove it.

Q. Will you answer the question now, as nearly as you can, when it first came to your knowledge that he had written this report?

A. I cannot tell. I did not attach any importance to it.

Q. You did not reply to it at the time?

A. One of those numerous diatribes against me was referred by the council to me for answer.

Q. That did not include this charge?

A. I don't know but that may have been the one.

Q. You don't remember whether it was or not?

A. I don't remember ; there were so many of them. If there had been only one, I should have remembered it, of course.

Q. When you say that by those figures there was a difference of 1,929 cubic yards in favor of Mr. Shanly, you reached that result, as I understand it, by measuring to the lines which you prescribed for arching?

A. Certainly.

Q. In point of fact, did he make a larger excavation than these prescribed lines called for?

A. Necessarily.

Q. How much larger?

A. That was at his own option ; but it was inevitable that he should make the excavation larger in the breaking of the rock. He was obliged to make these dimensions all through the Tunnel.



Q. Obligated to make it so that no point should be within those lines?

A. That is it, exactly.

Q. Much of it, according to the diagrams here shown, would be outside of those lines?

A. Necessarily.

Q. Then his actual excavation would be very much in excess of those quantities?

A. That is the fact all the way through.

Q. Can you give any estimate as to how much?

A. No, sir; it would be a very wild computation. If you should go through the Tunnel and see how in some cases rock with a fine grain breaks very close to the line, and in other cases the rock breaks very far back, you would see that it would be a very difficult matter to estimate.

Q. In no instance is the excavation within these prescribed lines, but there are many instances in which the excavation was outside of these lines?

A. That is the fact in the greater part of the Tunnel, necessarily.

Q. Would it be within bounds to say that he had taken down 30,000 cubic yards of rock outside of the lines?

A. No, sir; I say it would not be too large.

Q. You think he has taken down as much as 30,000 cubic yards in excess of your estimated quantities?

A. I have no doubt of it.

Q. Do you think it would amount to as much as 40,000 yards?

A. I should rather not guess up in that way; I answered you positively as to one quantity.

Q. Have you any computation showing your estimate as to the amount he has taken down outside of the lines?

A. No; I made up the other day a sort of guess computation for a certain distance.

Q. How much was it?

A. Well, I went over some of the worst ground that required arching.

Q. How much did you find it measured?

A. I found 8,000 yards.

Q. In what distance?

A. In 3,000 feet. That is to say, picking out the places that were worst of all.

Q. Were these 3,000 feet consecutive feet?

A. No, sir.

Q. (By Mr. TRAIN.) It wasn't a sample, even?

A. It wasn't a sample; it was just picking out the worst places

where we found broken rock that had been picked out again and again in taking down.

Q. (By Mr. ALLEN.) Have you got the exact places where it was taken, so that we can verify it by the diagrams?

A. Yes, sir.

Q. Will you let us have it?

A. Certainly, except that it is a conjectural estimate.

Q. That is all east of the central shaft, is it?

A. That is all east of the central shaft.

Q. You make here 8,633 cubic yards in 3,039 linear feet?

A. Yes.

Q. Then, west of the central shaft, in 5,538 feet, you make 14,005 cubic yards?

A. Yes, sir.

Q. Then, in 8,577 feet, you make it that he has excavated 22,638 cubic yards outside of the lines prescribed by you, do you?

A. Yes, sir.

Q. Was this in portions of the Tunnel where you will need to arch it?

A. It is in portions of the Tunnel designated by three experts as requiring to be arched. The experts who went over the work last autumn made certain conclusions, and I selected their points.

Q. Where it was needful, in their opinion, that the Tunnel should be arched?

A. Yes, sir.

Q. So that, if their opinion is followed, and the State should arch the Tunnel in the parts where the three experts unite in saying it ought to be arched, Mr. Shanly has done work that the State will have the benefit of, amounting to 22,638 cubic yards of excavation, outside of the lines prescribed by you; is that so?

A. That is a rough computation, but approximately correct, undoubtedly; intended to be so.

Q. Was there a certain enlargement made by the Messrs. Shanly for arching last year east of the central shaft, under a special agreement?

A. Yes, sir.

Q. How much per lineal foot in excess of the regular rock-section had been taken out at those points previous to the final enlargement for the arching?

A. To give you some general information, probably something similar, not quite as much, as the average shown by estimates just given, because these apply to bad places. My reply is entirely conjectural.

Q. Not entirely, is it?

A. Well, it is simply from general recollection, and not a distinct recollection, of those diagrams. I should say the average; not more than the average.

Q. How much did you allow in making the contract with him for that? How much did you assume to have been taken out in excess of the regular rock-section?

A. I had nothing to do with that. I was to pay him for the rock he took out; this was a new bargain.

Q. How much was it per foot?

A. I can't tell you per foot.

Q. Don't you remember?

A. No, sir. Why should I?

Q. (By Mr. SHANLY.) What is the difference per foot between an ordinary rock-section of the Tunnel, and what we call a brick-arch section, per foot? How much more per foot does it take to make room for the brick arch than for the regular rock-section?

A. Seven or eight yards per foot. It varies from six yards upwards.

Q. How much did you allow us for having taken out the rock at those particular points?

A. That is a question which I cannot answer.

Q. Would you remember if I told you?

A. I should probably identify it.

Q. You allowed us two and a half yards per foot. That is to say, you admitted that the whole of the brick-arch portion had been done previously, except a small balance of two and a half yards per foot. And yet that place, you said, was not an average in largeness of what we had done. You allowed us 2.57 yards per foot on that work. Do you remember that?

A. I can't identify it. In general terms, I told you, when the question was asked, that I had no means of identifying what the special condition of the Tunnel might have been at that point; but if there were no other means of arriving at it, I should take about the average. It was the only means that occurred to me for arriving at some indication of the quantity taken out. It appeared to me very possible that that portion of the Tunnel had been trimmed down on account of its insecurity more than the others had been.

Q. (By Mr. ALLEN.) Now, passing from that, I want to ask you a few questions about the water in the central section. You gave a written instruction to Mr. Shanly to go west in the work from the central shaft on the 2d of March, 1872, didn't you?

A. I think that was the date.

Q. After receiving the letter, dated February 28, 1872, from Mr. Philbrick,—do you remember that?

A. I do identify the time.

Q. Was this the first time that you had ever told the Messrs. Shanly that they needed more pumps?

A. I have no distinct recollection about it. It would seem quite possible that such was the fact; the matter was discussed, and it was conceived that the engineers had no right to prescribe to them. That was the view taken by Governor Washburn, that the engineers should not prescribe details.

Q. You did, in that letter of March 2, intimate to them that they needed more pumping-power.

A. Well, it was proper that I should state my opinion. In serving on him an official notice, it was proper that I should state what was very evident as part of the circumstances of the case, as part of the record. If he had gone on in blind obedience to those instructions, and been drowned out, he might have claimed that it was my duty to give him my opinion about it.

Q. In this letter of March 2, you say: "It is appropriate in this connection that I should communicate to you the opinion of the engineers, that your present pumping apparatus, if reinforced and increased only by the comparatively small amount which you are understood to contemplate, will shortly prove inadequate for the removal of the expected flow of water." I want to know if you had ever before communicated any opinion that there was insufficiency of pumping power?

A. I cannot identify or recollect any case of having done so.

Q. When those large pumps of his got fairly started, after the several mishaps that happened, which was in November, 1871, I believe, did you at that time consider them as sufficient for any probable needs for the prosecution of that work?

A. There comes the exact difficulty—

Q. Can't you answer "yes" or "no"?

A. I don't remember distinctly. Very likely I thought at that moment—the difficulty is this: a contractor will not make provision in advance unless he begins to perceive the emergency.

Q. My question is, whether or not you did then consider that he had made sufficient provision for pumping-power for any probable need in the prosecution of that work; what was your opinion?

A. Well, he had made sufficient for the present conditions and requirements, and something in advance of those, and he might have claimed the right to rest there until some development showed the need of further provisions.

Q. Did you think that provision was sufficient to enable him to prosecute his work continuously?

A. It was at the time.



Q. To prosecute it continuously in the future?

A. Well, that would be— I should say distinctly that I did not undertake to prophecy for the future.

Q. Did you at that time consider that he had made sufficient provision to enable him to prosecute his work continuously in the future?

A. It depends upon the length of time. How much time did you speak of? If you mean for the next three months, it is obvious that he had.

Q. Did you think he would encounter any such supply of water as would interrupt his work after that with those pumps which he then had?

A. My impression is, honestly, that I thought it was a matter of chance, to be shortly determined by further developments. We could not pretend to tell six months in advance what the developments in the Tunnel would be.

Q. Well, he had been at work in getting these pumps in ever since March of that year, had he not?

A. Yes.

Q. He had been engaged for nearly eight months in getting those pumps at work, had he not?

A. Yes.

Q. And to put in another pump of that size would necessarily require, as I understood you to say the other day, five months?

A. I said four or five months, probably.

Q. Now, did you think, in November, 1871, that he had made sufficient provision for pumping to enable him to prosecute that work?

A. Then I knew he had; he was going on with it.

Q. Continuously?

A. I have made a limitation; continuously for the present; I couldn't prophecy for the future.

Q. Did you then think that he ought to provide any more pumps?

A. I don't recollect; it is just the point that I cannot recollect at this moment.

Q. You cannot?

A. No.

Q. Do you remember whether, as early as November, 1871, you expressed any disapproval of the provision which he had made for removing the water?

A. I should say, in general terms, that I don't remember having expressed such disapproval until I found out what his intentions were. It was the expected plan of the future, that pumping-system

A, the one with which he sunk the shaft, should be replaced by a larger one, after the large pumping-system B had been put in operation. I should imagine that I supposed, or took it for granted (it was my business to take it for granted), that he would make sufficient provision, and that my first dissatisfaction probably was when I found he was intending to limit the capacity of that pumping-system A to a pump of only  $7\frac{1}{2}$  inches in diameter. It is made an 8-inch pipe, with a pump of  $7\frac{1}{2}$  inch diameter.

Q. Then you are prepared to state, are you not, that up to November, 1871, you did approve of what he had done in the way of making provision for removing the water?

A. He had been keeping right along, and had met with a series of untoward accidents, of which the most serious proceeded from the fact that those old foundations for the machinery, which were supposed to be sufficient, did not prove so.

Q. Supposed to be sufficient; were they not?

A. I can't tell anything about it.

Q. You supposed they were sufficient?

A. It was just one of those things which there was no supposition about; it was a matter of trial. There were foundations there which seemed probably sufficient to serve the purpose.

Q. Laid by the State?

A. Laid by the State; but they were laid by the State for a much less trying duty.

Q. Didn't you report that there was an unexpected defect in those foundations, which was discovered when those pumps were brought to bear?

A. It was a fact, whether I ever reported it or not.

Q. Did you ever intimate to Mr. Shanly, before he put in one of those pumps, that those foundations would probably be insufficient?

A. I don't remember any such intimation.

Q. Frankly, was it not as unexpected to you as to him?

A. It was a matter of grave consideration, I think, before the contractors' machinist concluded to employ them.

Q. The insufficiency of those foundations was as unexpected to you as to him, was it not?

A. I may say so, so far as my recollection now is concerned.

Q. The putting-in of the pumps was completed in August, 1871, and then there was this defect in the foundations, which you reported on in your report very fairly; it took him two months longer to replace those foundations; that took him until October; then he got started, and then some of the gearing broke, which took him nearly a month to repair; and finally, in November, he got his pumps at work, and they worked well?

A. Yes, sir; that is why I say there had been no question as to the matter up to that time. He had been diligently at work, in view of unexpected obstacles.

Q. Now, in your weekly report that you made November 3, 1871, I find that you state that—"The repairs on the large pumps were completed on the 31st instant, and pumping started, and has since worked well." Now, here I will quote your language, "And all the indications seem to favor the probability of a gradual resumption of all operations and continuous work"; do you remember that?

A. I think very likely that I made such a statement at that time.

Q. That is correct; it is taken from your report?

A. Yes, sir; I have no reason to doubt it.

Q. That would show, wouldn't it, approval of what he had done up to that time, by way of providing pumping facilities?

A. It would seem so, certainly.

Q. At the west shaft, where you speak of pumping a thousand gallons a minute, was the pumping-shaft separate from the hoisting-shaft?

A. The pumping-shaft was separate.

Q. Why was that?

A. There wasn't room enough; the hoisting-shaft was encumbered by steam-pipes and by air-pipes carrying the compressed air down, and it was found necessary to sink a separate shaft for pumping purposes.

Q. Is there any object in having a separate shaft for pumping?

A. The object is in having room enough.

Q. Would you, as an engineer, consider it advisable to have a separate shaft for pumping from what is used for hoisting, if you could?

A. There are certain conveniences in having a separate shaft.

Q. What are they?

A. The conveniences are not very material. They are, that the pumping apparatus at the foot of the shaft does not encumber the hoisting machinery, if you have the pumping-shaft separate.

Q. You don't think there is any particular object in having those two shafts separate?

A. I should aim, in projecting the shaft originally, to have one shaft, on account of economy.

Q. That is to say, supposing it was very deep; but supposing it was not a very deep shaft; suppose it wasn't over 300 feet?

A. The same rule holds as regards original projection. I should aim to have my shaft big enough. It is more economical to have

one shaft than two, on account of the expense of sinking the extra shaft. It is more convenient to have two.

Q. What is the convenience?

A. The convenience is in having your pumping machinery separate from your hoisting machinery, etc.

Q. Is there any liability of the one interfering with the other?

A. Well, that might be considered, perhaps, though this rarely occurs. It has not happened, to amount to anything of moment, in our experience at Hoosac Tunnel.

Q. How deep was that pumping-shaft at the west end?

A. 300 feet.

Q. 270, wasn't it?

A. Yes, that is the fact; I thought you asked in a general way.

Q. Is it any more difficult to pump up 1,000 feet than it is 270?

A. Why, yes.

Q. Take pumps that would pump 1,000 gallons a minute up 270 feet, how much can you pump with the same size pumps if you have to pump it up a thousand feet?

A. You would have the same; the only difference is, you have to repeat the pumps in sections.

Q. Can you operate them, so as to carry the water as fast?

A. Yes, because you repeat the pumps in sections; you hardly ever go above 300 feet in a single lift; then you pump the water into a tank, and use another pump for another section.

Q. Do you mean to say that one pump will not pump more water a short distance than a long distance?

A. We lifted higher at the west shaft than we did at the central; we lifted 270 feet at the west shaft; we only lifted about 250 at the central, as I recollect it.

Q. So that you think that with pumps of the same size, just as much water could be taken out of the central shaft as out of the west shaft?

A. With the same size pumps, if I am correct as to the separate lengths.

Q. How big were those pumps with which you took out 1,000 gallons a minute at the west shaft?

A. As I told you, we had three or four pumps at the west shaft.

Q. What was their capacity?

A. We had one pump that was estimated to carry 1,000 gallons a minute.

Q. About what was the diameter of it?

A. I think it was 20 inches.

Q. What is the difference in the capacity between a 7-inch pump and an 11-inch pump?



A. An 11-inch pump will carry three times as much, estimating roughly; not quite three times.

Q. I understood you to say, the other day, that on March 2, 1872, you thought the best way was to stop work, and put in more pumping-power; how long would it have been necessary to stop the work to do that?

A. I should say that of the four or five months, about half the time would have been actual stoppage.

Q. Would there have been delay, hindrance and inconvenience in the other half?

A. Yes, sir.

Q. How much?

A. It would have involved dumping the material down below; the same device which the contractor was obliged to use.

Q. For the whole four or five months?

A. Yes, sir.

Q. So that the material would have had to be handled twice?

A. Yes, sir.

Q. Now, from March, 1872, to December, 1872, when the headings were joined, what was the condition as to water in the Tunnel that was already excavated both ways from the central shaft; what depth of water was there; whether there was too much to wade through?

A. There was, for a good deal of the time.

Q. How did they get to their work?

A. They had to boat to it.

Q. For how long a time?

A. For some months.

Q. Where did they take the boats?

A. They took the boats at the bottom of the shaft.

Q. And went in boats to their work?

A. Yes, sir.

Q. What was done with the material that was excavated?

A. It was dumped into the bottom of the Tunnel. They were working at a top-heading, and the space they had previously made on the floor could be filled up.

Q. That would increase the rise of the water, wouldn't it?

A. Yes, sir.

Q. To that extent?

A. Yes.

Q. If you filled up the space with rock, it would make the water so much higher?

A. It didn't practically amount to anything, because provision was made to keep it down to a certain level.

Q. By pumping?

A. Yes.

Q. It was a pretty close pull, wasn't it? Didn't it come near drowning them out, as it was?

A. Yes.

Q. All the rock which was excavated that year, working east, in 1872, was taken up and handled twice, wasn't it?

A. Yes.

Q. It was dumped into the bottom of the Tunnel, and had to be handled again, the whole of it?

A. Yes.

Q. It was very difficult to prosecute the work under those circumstances, wasn't it?

A. Yes.

Q. It was a constant condition of being almost drowned out?

A. Yes; that is why I think it would have been better to have stopped work and put in pumps.

Q. And accept the delay of four or five months?

A. During 1872, a small pump was put in; a large pump probably could have been put in, with very little additional hindrance to the work.

Q. Well, on the 2d of March, 1872, was the first time you ever communicated to them the desirability of putting in any more pumps?

A. Well, as I say, I had been all the time under the impression that the second pump which was to be put in would be a large one; instead of that, it was made a small one.

Q. When was that put in?

A. During 1872.

Q. When you gave that order of March 2, 1872, what was done?

A. Well, Mr. Shanly appealed from my order to the decision of the governor and council?

Q. I mean, about the actual work; did he proceed to go west?

A. He did not proceed to go west.

Q. He did not at once, on your order; but did he not, after getting the order from the governor and council;

A. He never did go west at all, any more, until May, 1872.

Q. Do you mean that he did not begin to work west at all, any more, until May, 1872?

A. Not to make any penetration westwards; that is what I call working west. He was working enlargement.

Q. By Mr. Wederkinch's statement, the water was, on March 22, 106 gallons per minute; April 6, 137; April 15, 136; April 20, 132; May 1, 146; May 22, 205 gallons a minute; so that from

March 22 to May 22, it had increased from 106 gallons a minute to 205 gallons a minute. What caused that increase?

A. The main increase, I should say, was in the time when he began to make further penetration and extend length of drift westward.

Q. What made the increase from March 22 to April 6 of 31 gallons a minute?

A. It was partially due to contributions from the eastern headings which he was working.

Q. Was not some of it due to contributions from the western headings?

A. To some extent, probably; but in the enlargement, he probably had some addition. That is, in opening a larger area, he probably got some contributions from that side; that is all I can say about it; the addition to the flow came partly from both ways.

Q. Wasn't the excavation changed at that time in the work west of the central shaft, from the top heading to the bottom heading?

A. He was allowed to change his plan, and to complete that enlargement.

Q. He was not at work on that in April, was he?

A. He was on the enlargement of the west heading. He was driving the heading east all the time. He did not attempt an enlargement east.

Q. At the time you gave this order, of March 2, 1872, for him to go west, you didn't think it was a wise thing for him to do, did you?

A. My impression was this: that it was the decision of the governor and council; that I had nothing to do with the details; that the contract required certain things, and the only way was to require him to do those things. He was to accomplish them as nearly as he reasonably could, and if not, show cause why.

Q. You didn't think, in view of the water there, that it was a wise thing for him to undertake to do it at that time?

A. I expected him to say that he should go west as soon as the proper pumps and machinery could be provided.

Q. You didn't expect he would undertake to go west until the proper pumps had been put in?

A. I may say, in general terms, that was the course I should have adopted in his case.

Q. Wasn't the order imperative for him to go west, anyhow?

A. The order was imperative as a requirement to go west as soon as possible.

Q. At once?

A. No imperative order was given; that is to say, a contractor, on receiving notice of any requirement, has a right to, and should,

represent the circumstances, if it involves any special difficulty to him. I don't recollect distinctly about the question of going west at that time.

Q. Mr. Frost, I see your letter says as follows:—"I have to notify you of the conclusion of the executive council that you must be required to resume at once the progress at the heading westward from the central shaft, and also to continue to follow up the progress of enlargement as now doing, in accordance with the provisions of your contract." That is a requirement for him to go on with the heading at once, isn't it?

A. To go west, certainly.

Q. That is not subject to any question of waiting four or five months to put in some more pumps; it is an imperative order, absolute, to go ahead at once?

A. If I have but one resource under a contract, and that is to require a man to do any necessary work, he is obliged to do it as nearly as is reasonably practicable—

Q. He is obliged to do it, under this order, whether he can or not?

A. There is the language of the contract—

Q. All I want to know is, whether you recognize that he was required to do a thing that could not be done?

A. Up to that time he could go ahead west.

Q. Yes, but you said a little while ago, as you did the other day, that you thought it would be wise to stop and put in pumps; that you didn't think it was wise to undertake to go on?

A. He had not got up to his capacity then.

Q. You said a few moments ago, that you didn't think it was wise for him to go on with this work, but you thought it would be wise to stop work and put in a pump?

A. I did, and he would then have been amenable to the willingness of the council to waive the contract—

Q. He had had a discussion with the council before this, had he not?

A. No, sir; it was after, as I understand.

Q. You did not expect him to obey that order of yours, but you expected him to appeal to the council, did you?

A. I expected such appeal; yes, sir.

Q. You didn't expect him to obey it as coming from you?

A. I will tell you what I supposed, Mr. Allen. I supposed that he would obey it for the time, and then just so soon as he was ready to put in pumps, when he had made the preliminary orders, etc., he would then make an appeal for a waiver of the order, until he could get his pumps in.



Q. Don't you think he tried pretty hard to get relief from going west?

A. Yes, sir.

Q. Didn't he beg, and beg, and beg, time and time again, to have that order suspended?

A. I believe he made that appeal.

Q. And very strongly, and very persistently?

A. I understand so.

Q. It was within your knowledge that he appealed to the council, over and over again, not to be compelled to prosecute that heading west?

A. "Over and over again"; I shouldn't like to say that.

Q. Well, say four or five times?

A. I didn't know that.

Q. How many times did you know of?

A. I know of this indirect contravention of my order which you read of this date, March 2.

Q. Don't you know he begged just as hard as a man could possibly beg, that that order might not be enforced upon him?

A. I know, in general terms, he was opposed to that policy.

Q. Very strongly opposed, wasn't he?

A. Exactly.

Q. But, nevertheless, the order was given, and you thought at the time it was given that it was not wise to expect him to go on until a pump had been put in?

A. Only for a short time, until he could make his preparations for putting in his pump. Of course there were some preliminary orders to be given for provision of material, etc., and meantime he could have done some work there, perhaps, but it would not have been a great deal.

Q. There has been an order put in here, as follows:—

JUNE 14, 1872.

Messrs. W. & F. SHANLY.

GENTLEMEN:—Whereas, Edward S. Philbrick, engineer, has reported that the progress of the work west of the central shaft is not satisfactory, the amount of certificate No. 19, for which an order would have been drawn, has been withheld.

An opportunity will be given you to appear before the council next Thursday, at 12 M., if you desire to be heard.

Very truly yours,

E. B. STODDARD.

Q. Mr. Stoddard was, at that time, one of the executive council?

A. Yes, sir.

Q. And on the Tunnel committee?

A. Yes, sir.

Q. Did you approve of that order of June 14, 1872?

A. I didn't have anything to do with it, sir.

Q. Weren't you consulted?

A. Well, I don't remember.

Mr. ALLEN. That, more properly speaking, is a letter, or notification, from Mr. Stoddard. The order in council is of the same date. I have it here, as follows:—

JUNE 14, 1872.

*Ordered*, Whereas, upon special report of Edward S. Philbrick, consulting engineer of the Hoosac Tunnel, made upon return for the month of May, 1872, that the Messrs. Shanly, contractors, have not performed their contract in the progress of the work, the certificate No. 19, which would otherwise be due, be withheld until further orders.

JUNE 14, 1872.

In council, order adopted.

OLIVER WARNER, *Secretary*.

Q. I want to know whether you approved of this order?

A. I looked on this order of June 14 as the logical sequence of the hearing in March, in which Mr. Shanly had proposed a different method of working for a certain time, and, as I understood then, if his conjectures did not prove correct, he would be prepared to adopt what was ordered March 2.

Q. This was an order stopping his money, wasn't it?

A. I am not talking about the order stopping his money. I am talking about the notice to him. These things were transacted in the council chamber when I was at work.

Q. That was an order stopping his money?

A. Yes, sir.

Q. Wasn't that in consequence of his failure to do work west of the central shaft?

A. Mr. Philbrick's letter will tell that. I really don't know. I have no recollection at present what the council may have done.

Q. I see that this order says, "Whereas, Edward S. Philbrick has represented the progress of the work, west of the central shaft, as not satisfactory"?

A. Yes, sir, that is the fact.

Q. Now, did you understand that it was because of the failure to prosecute that work, west of the central shaft, that this order was passed withholding his money on the 14th of June?

A. I am not, at this moment, certain of my understanding at all about that order, or knowing of it, at the time. I don't remember whether a copy was sent me or not.

Q. Were you consulted as to whether he should be required to go on west or not?

A. I don't remember that I was.

Q. Did you express any opinion about it?

A. I don't think I did, at that time.

Q. Did you have any conference with Mr. Philbrick about it?

A. That would be going very far into a matter of recollection. As I told you before, I looked on this notice as the logical sequence of the hearing of March. I didn't know of it in any way that I remember. I don't remember anything except the statement of facts.

Q. Did you think at that time that it was reasonable to require him to do more work west in June, 1872?

A. There was a certain understanding at the council meeting in March. He had then entered into certain requirements. If the council thought proper to call on him to do exactly what they understood him to have engaged to do, and what they thought the contract required, it was a matter not for me to decide.

Q. In view of the amount of water that was coming in at that time, did you think it was reasonable to require him to undertake to work west of the central shaft at that time?

A. I have already explained that requirement.

Mr. MOSELEY. Why can't you answer the question?

A. I don't remember. I am not certain that I knew of the notice.

Mr. MOSELEY. I think this is unfair to the Committee. They have stood it pretty well, but I don't propose to stand this kind of quibbling. I come up here for information, and so do the other members of the Committee, and I object to this witness going on "whipping the devil round the stump" in this way. I don't see how you stand it. The gentleman asks a plain question, and the witness goes all round the barn, and by the time we get the answer, we have forgotten what the question was. I think he should answer "yes" or "no"; and if he does not know anything about it, we will pass on and take some one who does. I am willing to give all the time that is necessary to this investigation, but I think it is outrageous to have it go on in this way. It is utterly impossible to get a direct answer out of the witness.

Mr. ALLEN. I think so; but I have done my best to make him answer.

Mr. ———. If he will say he don't know, or he don't recollect, that will answer the question.

Q. The question is whether, at the time that order was passed, you thought it reasonable for him to undertake to prosecute the work west from the central shaft?

Mr. TRAIN. It is entirely immaterial whether he did or not. I object to the question. I have kept quiet, because I did not choose to interfere. But it is no matter what he thought; the action of the council was to control, and if he kept within the contract, that was all they had a right to require.

Mr. ALLEN. If they required impossibilities of the Messrs. Shanly; if they required what was certain to ruin the work, under the advice of their consulting engineer and superintending engineer; and if, as the consequence of that requirement, the Messrs. Shanly were put to an expense of \$217,000, as we say was the fact, then I want to know if the Commonwealth of Massachusetts is going to force Mr. Shanly to bear that expense which is put upon him by the blunders of the State.

Mr. ROBINSON. I want to get at Mr. Frost's opinion about that matter. I think that is a fair basis for us to work upon. Here is an engineer who was right on the ground and knew all the circumstances at the time.

Mr. TRAIN. I have offered to put in, and am going to put in, if I can ever get a chance, the letter of Mr. Philbrick upon which these orders were passed; and now the inquiry is, whether Mr. Frost substantially concurred with Mr. Philbrick. Well, who cares whether he did or not?

Mr. MOSELEY. I submit, that for one, I care. I want to know what this man's judgment was about it, who was there to see that this contract was carried out. I submit that is a proper question.

The CHAIRMAN. I suppose it would be a judgment that varied from day to day. To-day he might think that the pumping power was sufficient, and to-morrow he might think that it was not sufficient. Suppose he cannot tell, that his mind changed from time to time?

Mr. MOSELEY. Then let him say so.

The CHAIRMAN. He says he had not made up his mind. He says that he thought at the time the pumps Mr. Shanly put in were sufficient, but then he couldn't tell.

Mr. ALLEN. That was in February, 1871. I am asking him now as to the 14th of June, 1872, whether he, as an engineer, thought it was reasonable to require Mr. Shanly to work west; that is a question I would like to get his opinion on, if I can.

Mr. PRATT. Whether it was reasonable or not, without regard to the contract?

Mr. ALLEN. I want to know whether, in view of the actual facts on the 14th of June, it was reasonable to ask the Messrs. Shanly to prosecute that work west?



Mr. PRATT. In other words, whether, if he contracted to do the thing, it was reasonable to ask him to do it?

Q. (By Mr. ALLEN.) Well, Mr. Frost, that is the question, whether you, as an engineer, on the 14th of June, when that order was given, thought it was reasonable to require the Messrs. Shanly to undertake to prosecute that work further west?

A. I should suppose that it was for the council to require him to carry out the contract, and it was for Mr. Shanly to show, if there were reasons why he should not do so, what the reasons were.

Q. You were acquainted with the condition of the water there at that time, were you not?

A. Yes, sir.

Q. I find Mr. Wederkinch's schedule gives 237 gallons per minute, on June 10; now, as an engineer, with 237 gallons a minute coming in there, did you think it was reasonable to undertake to prosecute the work west from the central shaft?

A. In the state of things, it was a matter of immediate suspension. Of course, they had got up, for the time being, to the capacity of their pumps, and immediate suspension was, of course, inevitable; but that flow began to diminish—

Q. I am talking about the way it was on the 14th of June.

A. Well, that was in the time when he had the greatest flow; that is to say, between the 2d and the 14th, there was no substantial difference occurring.

Q. Did you think that the work could be prosecuted further west at the time successfully, with such provision as existed for removing the water?

A. Not with that provision; no, sir.

Q. Did you report to the governor and council?

A. I think it very likely that I did.

Q. Will you see if that is your report, on the 10th of June, 1872?

A. That is my report; I identify that, of course.

Mr. ALLEN. I will read some sentences from this:—

“The arrangements for giving somewhat enlarged performance to one of the pumping systems which have been for some time in progress are now substantially completed, and expected to be put in operation this day, June 10. Probably a trial will be made to-day, but a day or two will be required before full work can be obtained from it. With the large capacity now to be afforded, the aggregate capacity of the two pumping systems is not any more than adequate for the safe removal of the water now making in the Tunnel.”

Q. Was that your opinion at that time?

A. I have already stated that it was; I have somewhat anticipated that.

Mr. ALLEN. If you had said that half an hour ago, we should have got along faster.

Mr. TRAIN. If you had stuck that in his face half an hour ago, you would have got your answer.

Mr. ALLEN. I wanted to see whether he would say the same thing now.

Q. Well, then, you did not think at that time that work west could be prosecuted, reasonably?

A. Not until some arrangement was made.

Q. And it would take some four or five months to make that arrangement?

A. I never considered that matter.

Q. Well, how long would it have taken to make the arrangement? How long would it have taken to make further provision for pumping?

A. Probably it might have taken four or five months.

Q. That would have brought it up almost to the time when the headings were actually joined?

A. Well, probably not so long. The work of the past summer could have been made partially available; I mean the work of putting in pumps that had been done during the past summer.

Q. You mean, probably it would not have taken four or five months?

A. I don't think it would.

Q. Do you think it would have been an expedient thing to take the requisite time to put in pumps, considering that they were within six months of joining the headings?

A. It would have expedited the completion of the Tunnel.

Q. Wouldn't the work have been delayed by the time taken to put in the pumps, more than it was in the way it was carried on?

A. Not towards the completion of the Tunnel.

Q. How much would it have expedited it, in your opinion?

A. If we allow the contractors three months' time to get started there, they would have commenced on the heading west of the central shaft in September, instead of December; that is to say, October, November, and December,—three months sooner.

Q. You think it would have made three months' difference?

A. I mean that; as you must recollect, there was no progress westward until after the meeting; progress westward would have been resumed as soon as the pumps were in.

Q. How big pumps would you have put in?

A. I should probably have duplicated the pumps he had there.

Q. Would you have dared to go westward then?

A. Yes, sir.

Q. How could you tell that within ten feet you would not strike more water?

A. Only as I told you yesterday; the whole thing must be a matter of general belief, not of conjectural possibilities.

Q. What previous experience had you had in tunnelling before you undertook the experiment on this work?

A. Well, I built one tunnel on the Baltimore and Ohio Railroad.

Q. How long was it?

A. Something about half a mile; also, there was a small tunnel on the Central Park in New York, and a tunnel on the Washington water-works, which was part of the work under my charge there.

Q. How long was that tunnel in the Central Park, New York?

A. It was only a very small matter. The building of the Bergen tunnel was in progress at the same time, and my early employment on the Baltimore and Ohio road led me to be interested in tunnel works, and therefore to visit that while in progress.

Q. You have spoken about the difficulty that you had in getting anything accomplished up that way; I want to ask you whether you reported to the joint standing committee for the year 1871, in a communication dated February 5, 1872, giving an account of the work done in the year 1871, as follows: "The progress made during the year by headings entering respectively from the east and west ends has been very satisfactory, considerably exceeding the advance of the preceding year, and surpassing the average rates originally prescribed by the contract"?

A. I remember those words just as well without identifying them; those were all facts.

Q. That was true for the year 1871?

A. Yes, sir.

Q. Now I want to ask you if, to the committee of the following year, under date April 15, 1873, you reported as follows: "The operations during the year by Messrs. Walter and Francis Shanly, contractors, upon their contract for the completion of this work, were prosecuted with most excellent resource and energy. They have been attended in some respects with an exceptional measure of good fortune and exemption from hindrances, and have attained results of progress eminently satisfactory, in view alike of the sources of delay which were apprehended, and of the actual difficulties met and surmounted"?

A. Yes, that is all so.

Q. That was true, was it?

A. Yes, sir, it was true. I considered this matter of controversy waived, of course, at that time.

Q. Now I will ask you whether, in that same report, you went

on to say in subsequent portions of it: "With the single exception of progress westward from the central shaft, which was suspended in February, the advance of the past year in the work of driving the headings may be said to have been substantially without peculiar hindrances, and the results obtained have satisfied the most sanguine anticipations. In the heading from the west end, up to January 1, 1872, the whole length obtained was but 32 feet in excess of the contract requirement. For the year following, the contract would require a contract of 1,200 feet. The actual length penetrated was 1,616 feet, an excess of more than 33 per cent." Do you remember that?

A. I do.

Q. [Reading.] "This very favorable result is paralleled, as to ratio between required and actual rates, by the very creditable as well as very fortunate progress which has been accomplished through extraordinary efforts in the heading eastward from the central shaft. In this, the contract rates would require for the 11½ months' work which preceded the junction made with the east-end section, December 12, a length of 920 feet; and the actual amount accomplished was 1,226 feet, an excess of very nearly 33 per cent." Is that so?

A. The words are in print, and the figures are undoubtedly correct. I took pains to see that the figures were correct.

Q. Was this the work that was done where they had to resort to boats to get to it, and where they had to dump the material in the bottom of the central shaft, where they had to handle it over again?

A. Yes.

Q. And they got 33 per cent., under those difficulties, in excess of the contract rates, going east?

A. Yes.

Q. You go on to say, in reference to this progress, "It should, however, be remembered, that the extraordinary progress is due largely to the extraordinary exertions made." Is that so?

A. Yes.

Q. "Extraordinary exertions" made by whom?

A. Why the "extraordinary exertions" of the contractors, certainly.

Q. Not your own?

A. No; my simple province was to direct the work.

Q. You considered, at that time, that they had made "extraordinary progress" by reason of the "extraordinary exertions" made?

A. In the point specified.

Q. Then I want to know if you didn't report to the committee of the following year, under date March 20, 1874: "The opera-



tions of the contractors for the past year have been much more productive, with regard to the force employed, than those of any previous year." Is that true?

A. Yes, that is the fact on that end of the work.

Q. Reading these reports, I was a little surprised to hear the statement that you made the other day of the difficulty there was in getting anything done up there.

Q. I will correct you by saying, that that reference to the matter of progress did not refer to this part of the work.

Q. What did it refer to?

A. It referred to the getting out of the Tunnel to correct size.

Q. That was what you had the worry about?

A. This pumping system was a matter which gave me some worriment at the time.

Q. Well, you would not want to give the idea, then, that you did in your testimony, when you said if you complained of everything that went wrong, you would have been in a worry all the time?

A. I was speaking of trifles; the inquiry was made of smaller matters of detail, and I spoke of them.

Q. But, in the great matter of getting that Tunnel completed, you really thought that they had developed great resource and great energy, didn't you?

A. Certainly I did; in these special things which delayed its completion. There were also other things that might have been done, but when these further points of demand were waived, I didn't have anything more to say about them.

Q. Frankly, didn't they display, to use your own language, a "resource and energy" in combating difficulties which were really extraordinary?

A. They deserve much credit for their efforts and exertions.

Q. Would you hesitate to use the word "extraordinary" as characterizing the "resource and energy" which they exercised in overcoming difficulties?

A. I have sought to praise it rightly.

Q. Now, I would like to ask you a few questions in regard to that Haupt Tunnel. You recognize, I believe, that that was a necessary element in the prosecution of the work?

A. It was a necessary element of the economic prosecution of the work. It might have been finished without ever using the Haupt Tunnel, but the use of it was part of what Mr. Shanly calculated on to complete his work.

Q. And he had a right to calculate on it under the contract?

A. That is so.

Q. This necessity, which seemed to exist, of interfering with the Haupt Tunnel, arose, how?

A. It arose from the fact that it was needful, eventually, in order to effect the completion of the railroad cutting approaching the Tunnel, to blast out a portion of the Haupt Tunnel, and make an open cut of it.

Q. Was it originally contemplated that the Haupt Tunnel would be used as a part of the railroad line?

A. That design was not stated, or in any way provided for, in the contract with W. & F. Shanly.

Q. You recognize, then, that the destruction of the Haupt Tunnel was really an interference with his rights under his contract?

A. Yes, sir, certainly; I think I did so admit in writing to him.

Q. Whatever injury was done to him in that respect was depriving him of what he had a right to have?

A. That is the way I looked at it. I proceeded on that supposition through all my action in the matter.

Q. In consequence of the Haupt Tunnel being interfered with and injured, did they have to resort to any different method of doing their work?

A. Yes, I think they hoisted more material up the west shaft than they otherwise would have done.

Q. Were they not compelled to erect hoisting works on purpose?

A. Yes.

Q. Don't you remember that they communicated to you that they would be under the necessity of doing it?

A. I did recognize it as a necessity.

Q. You wrote expressing yourself as glad that they did it, did you not?

A. Yes, it relieved me from a difficulty.

Q. That would be more expensive to them than if they could have got the material out of the west end?

A. Yes, it was.

Q. Then, of course, they should be allowed for that expense whatever it was worth?

A. That is set forth in the correspondence.

Q. You found it to be the case that the Haupt Tunnel could not be preserved so as to be opened for transportation?

A. I think I made all the efforts reasonably possible.

Q. And it could not be done?

A. It could not be done; that is, it was not reasonably possible.

Q. How long was the ground occupied out there so that exit in that way could not be had? Was it not until September, 1874?

A. Yes.

Q. Then, if there was any work of the Messrs. Shanly that required exit at the west end, they could not have it until September, 1874?

A. That is the fact.

Q. Was there any work that they had which required exit at the west portal?

A. They had a good deal of work which was economically of that kind.

Q. They were required to close up that west shaft, were they not?

A. That was a part of the completion of their contract.

Q. They could not close up that until they got exit at the west end, could they?

A. No.

Q. Was there not work near that shaft that could not be done until the shaft was closed?

A. Yes.

Q. So that, really, they could not get on and finish the Tunnel until this exit was obtained at the west end?

A. There was a small length under the shaft that could not be worked without greater expense than is involved in this claim here.

Q. Wouldn't it break their machinery, if they blasted right under the shaft?

A. Yes. The only alternative would have been to run their rock out at the west end, and lift it up, as they did in the excavation at the west façade.

Q. Then there was a delay in doing that work until they got exit at the west end?

A. I recognize it; yes.

Q. How much work would that amount to that was so delayed?

A. It was the cleaning out of the whole bottom of the Tunnel. I should suppose there was a mile and a half there that would probably average a yard and a half to the running foot,—10,000 yards say; that is a very rough estimate.

Q. That they had to do after they got their exit in September, 1874?

A. That they could most profitably do in that way.

Q. Well, there was some portion of it that they could not do until they gained an exit through the west end, until you let them out there, wasn't there?

A. Of course, by more expensive working they lifted part of their material up the west shaft.

Q. But they had to close the west shaft?

A. They left a length of Tunnel, say 60 or 70 feet, to be done at a very late moment.

Q. Didn't they lift up, through the west shaft, all they could?

A. Well, all they profitably could; that is to say, they worked it in the most economic way.

Q. They were actually delayed in the completion of that portion of the Tunnel by the impossibility of getting out of the west end, weren't they?

A. They were, by reason of their dependence upon getting out of the west end; the expectation of getting out there, probably.

Q. You found you couldn't let them out any sooner; you let them out as soon as you could, didn't you?

A. I did.

Q. What was the reason you couldn't let them out in June or July, 1874?

A. Simply because there was work on the railroad to be executed, right next to their work.

Q. You hurried the contractor all you could?

A. Yes.

Q. You could not get him out of the way; you tried to get him out of the way, so that that exit would be furnished as early as May or June, 1874, didn't you?

A. I urged it all I possibly could.

Q. But you couldn't accomplish it, and so it kept along until September, 1874?

A. Yes.

#### RE-DIRECT.

Q. (By Mr. TRAIN.) There was a fact brought out which was new to me yesterday. I want to go back to the matter of the grade of embankments. You said yesterday that there was an allowance to be made to the Shanlys for alteration of grade. What was that alteration of grade?

A. After the work of filling had gone on for a certain distance, when I came to consider the matter of final height for that bank, I found that by changing the grade lower than Mr. Field had intended, I could save largely to the State in ballast, and I discovered also that it would be necessary to fill the top of the bank, over part of its length, to come up to the grade. I made the change, and notified Mr. Shanly of it, when the proper time came for levelling off the top of the bank.

Q. Well, what arrangement was there between you and him for his compensation for the work occasioned by that change of grade?

A. That I should compensate him for it in what I call "current account." This included certain bills for labor and material furnished by him—part for the railroad and part for the Tunnel—outside his contract. I was allowed to pay these by the permission of the



governor and council, on "current account." The money was sent to me simply for the convenience of not mixing up these matters with the treasurer's accounts.

*Q.* They are outside the contract?

*A.* Yes. This work was on the railroad; this change of grade on the top of the bank had nothing to do with the contract on the Tunnel.

*Q.* Was that the reason it was not brought to the attention of the governor and council in the settlement in December?

*A.* When he brought in his claim in December, he made out his claim to include the amount for which this voucher or bill should be made. That is, he made a claim to be paid for the whole cost of the work on the top of that bank, which, of course, included in it these few hundred dollars for this item of change of grade which I had agreed to pay him for. The greater included the less, and I therefore let the whole claim go before the council for consideration on its general merits.

*Q.* What I want to get at is whether that is included in the \$600 allowed by the council?

*A.* I don't think it is.

*Q.* Then it is to be included in your "current account" which you are to settle with the Shanlys?

*A.* Yes, sir, which I am to settle with the Messrs. Shanly, unless the Committee take it in here. I am ready to pay the amount, if they decide that they will not take it into consideration, but allow me to pay it.

*Q.* How large a "current account" have you with the Shanlys?

*A.* I think \$1,300 or \$1,400. This payment ought to have been made immediately following the settlement, and if I had known the exact amount, I should have provided for the payment at once; but not having computed the quantity, it passed until Mr. Shanly had printed his claim, including that amount in his claim as presented here.

*Q.* Now, we have not been told anywhere yet the amount of expense occasioned by that change of grade.

*A.* I stated to the counsel on the other side that I had expected to bring my account down, but through the misunderstanding of my assistant, who is to furnish me the details, I did not have it at hand, but I would furnish it within a week.

*Q.* Is there any dispute between you in regard to it?

*A.* No, sir.

MR. SHANLY. I never have had any opportunity to dispute it, because I never knew what the amount was.

WITNESS. It is simply a question of taking out so much from

your claim. When you get it you will reduce your claim here. I take it for granted, on a question of figures, there can be no dispute. It is written down just how it should be computed, and if I make any mistake, you will have an opportunity to correct it.

Mr. SHANLY. You never told me how much the change of grade was.

Q. (By Mr. ALLEN.) When was that work completed?

A. Last fall, a year ago.

Q. (By Mr. TRAIN.) You told Mr. Allen that you kept back in your estimates for not trimming, at the rate of \$40 per yard, a very considerable sum. Under what provision of the contract did you do that?

A. My business under the contract was to estimate the value of the work done. There came up to the attention of the governor and council the fact that perhaps I was estimating more than the value of the work done in paying them full price for excavation, when they did not accomplish the trimming.

Mr. MOSELEY. Which item does that come under?

Mr. SHANLY. That is not in the statement at all. I never made any claim for it.

Mr. TRAIN. It was a matter brought out on the cross-examination by Mr. Allen yesterday. I suppose it may affect the question of interest. I suppose that is the idea Mr. Allen had in his mind.

WITNESS. The matter was considered, being a grave one, of instructions, and I was finally instructed to deduct the value of such amount as remained incomplete.

Q. From what time to what time was that withholding of the amount continued?

A. I can't tell without reference. I will ascertain and make the answer, if desired.

Q. Can you ascertain, at the same time, the amount which you withheld in that way?

A. I think I can.

Mr. TRAIN. You may make a memorandum of that, and if it becomes important I will recall you.

Q. Now I want to go into this matter of the error of Mr. Wiliston once more. I don't think Mr. Allen understood how that error arose, and I don't know that I should from the examination. Can you state how that error arose in the estimates which Mr. Wiliston made?

A. No, sir; except that in general terms there was a certain length of Tunnel to be opened. This computation showed the number of cubic yards, and decimals of cubic yards, to each foot. It was simply a matter of multiplication.

Q. I know it, but did it arise from his taking a wrong line, or what?

A. It may have been an arithmetical mistake; but I do not think it was. I think it more likely to have resulted from an improper interpretation of the position of the line of floor. It is a very small decimal, as it appears.

Q. You spoke of all these estimates being very largely conjectural; how largely?

A. The only question of largeness of conjecture appears in the difference between the amount as it turned out in that west-end section and the amount I originally estimated. That is, the best measure of something which could not be determined in advance.

Q. Now, of the 22,638 yards excavated outside of the lines, what portion of it was occasioned by his working overhead easterly from the central shaft, outside the lines?

A. I seem to have mislaid the paper which would enable me to answer that question.

Mr. TRAIN. Will you make a memorandum of that and let me know some other time?

Q. If I understand you, Mr. Frost, in relation to the matter of pumps, if they had put in a pump of the capacity of the large pump, instead of the smaller pump, it would have been able to have removed the water and kept the shaft free, and it would not have taken them any longer, substantially, to put in a large pump than it did to make the change they did?

A. It is probable it would not, except that it would have involved an entire stoppage eastward for a time.

Q. You say he appealed from your order and did not go west until May 7, 1872. You expected him to put in pumps and go ahead. When did you expect him to put in pumps before that time?

A. After he got the order of March 2, of course, in connection with Mr. Philbrick's letter.

Q. He had had abundance of time by that time to have made this change and put in this large pump instead of the small one, had he not?

A. If he had anticipated it; but his hope was that they might not encounter large flows of water.

Mr. SHANLY. That was not my hope; don't speak for me; I never hoped that. That might have been your hope; it was not mine.

WITNESS. Well, I am corrected in that impression.

Q. Will you tell us why putting in a large pump would have involved stopping the mining eastward from the central shaft? Why couldn't they have put in that large pump and still kept on

their mining and dumped into the Tunnel, as they had done before?

A. I said there would have been some delay necessary in putting down larger pumps.

Q. I suppose there would, but why couldn't they have gone ahead, as they did go ahead, eastward, while they were putting in the large pump instead of the small one?

A. Well, I don't recall the absolute reason why they should not now.

Q. Well, you said just now it would involve their stopping mining east?

A. I said probably for a couple of months, or for half the time.

Q. Well, what makes you say that?

A. Well, I perceive that what I looked on as a matter of policy has been mistaken as a matter of absolute necessity; that is the difference. I do not see any absolute necessity for a stoppage.

Q. When you say it would have involved the necessity of their stopping mining east, do you mean to say that it would have been good policy for them to have stopped mining east while they were putting in the large pump?

A. Some part of the time, I think it would.

Q. And that is all you mean by it?

A. That is what I mean by it.

Q. In your communication, I think, of June 10, 1872, you say they cannot go west until further means of pumping are provided; why should they not have provided further means of pumping before that time?

A. Well, I know no reason, except that they didn't choose to. Their policy was different; that is, to cut through eastward, and save the expense.

Q. They might have done it, if they had been disposed to?

A. Yes, sir.

Q. Mr. Allen has called your attention to your report of Feb. 5, 1872, on the work done in 1871, in which you speak flatteringly of the average amount of work done. That work, as I understand it, to which you refer, was in the eastern section and western section, not in the central part of the work?

A. I think so.

Q. Now, Mr. Allen read from your report of April 15, 1873, in which you speak of their getting along exceptionally well; I want to know whether, in making that report, you count the progress from the commencement of the work, or limit that remark to certain months?



A. I think I specifically state its limit being dated back to the average rate of progress required.

Q. Well, you count certain months by themselves, and say they got along exceptionally well?

A. That is what I mean; or rather, certain portions of the work by themselves.

Q. I have forgotten whether I asked you in the examination in chief or not, why \$81,000 was paid in November, 1874, which was claimed by Mr. Allen to have been \$60,000 more than the amount earned in the previous month. There was some reason, I suppose, why you should pay that in excess?

A. Yes, sir; I answered it before, but I can answer it briefly again. It was this. It was found, as appears by this statement, which I submitted just now, that the areas and prices by which I had proceeded to estimate under the contract, if strictly adhered to, would leave a large balance unpaid to the Messrs. Shanly, and apparently unearned. Out of that, it became entirely discretionary with the governor and council to add other items of work to the estimate schedule, in order to use up such part of this surplus as they might deem it appropriate to pay to the Messrs. Shanly. This is what was done at that time, they having Mr. Shanly's representation that he found it an inconvenience not to have as much money as might possibly be paid him by a liberal interpretation of the contract.

Q. (By Mr. CUMMINGS.) Have the contractors been paid anything for the destruction of the Haupt Tunnel?

A. I think not.

Mr. TRAIN. That was omitted; the Shanlys saying they were coming to the legislature, the governor and council said they would decline to consider it.

Q. (By Mr. SHANLY.) Supposing we had proceeded, in March, 1873, to put in a second 11-inch pump, which you think would have been sufficient, and driven westward, and supposing we had struck a thousand gallons a minute, how would that have affected the ultimate completion of the Hoosac Tunnel?

A. If you had encountered the water immediately, it would have delayed it.

Q. Supposing we had struck five hundred gallons a minute, would not that shaft have filled, in spite of us?

A. It would.

[Adjourned to Thursday, at 10, A. M.]

THURSDAY, March 18, 1875.

TESTIMONY OF EDWARD S. PHILBRICK.

Q. (By Mr. TRAIN.) Will you state your name and place of business?

A. Edward S. Philbrick; place of business, Boston; born in Boston about 47 years ago; I have been a civil engineer since 1846.

Q. Have you held any appointment under the State in connection with the Hoosac Tunnel?

A. I was appointed consulting engineer upon the Tunnel in February, 1871.

Q. When were you first employed on the Tunnel in any capacity?

A. I was employed some months previous to that on special duty.

Q. State what that special duty was.

A. There had a doubt arisen as to the correctness of the working lines of the Tunnel. Representations had been made as to their inaccuracy, and the council thought it expedient to call in a new man to test them, and they called on me.

Q. Who was the engineer who raised the doubt?

A. My predecessor, as consulting engineer, had questioned the correctness of the lines; stated his belief that they were not correct; and I was called upon to ascertain the facts, and report to the governor and council.

Q. Who was your predecessor?

A. Mr. James Laurie.

Q. It was a difficulty between him and Mr. Frost, was it?

A. A dispute had arisen between him and Mr. Frost. Mr. Frost claimed that he was right, and Mr. Laurie claimed he was wrong, and I was there for several months personally, at every opportunity that I could seize, working in the Tunnel, or outside, when the weather would allow. I made a personal survey, first of the outside line, and then of the inside line, up to the headings.

Q. When did you say this was?

A. I began in early autumn, 1870, and didn't conclude until the next spring. I made a preliminary report, however, I think, in January, 1871.

Q. The result of it was that you found Mr. Frost to have been correct, and Mr. Laurie to have been wrong?

A. Yes, sir.

Q. Prior to your report, had Mr. Laurie been removed.

A. I made my preliminary report, I think, previous to his removal.

Q. You had nothing to do with the execution of the contract?

A. I had nothing to do with the contractors except to get information on the ground, and report my advice whenever I thought best, or whenever it was asked for.

Q. I mean, with regard to making the contract?

A. The making of the contract I had nothing to do with.

Q. After you became consulting engineer, will you state what your duties were?

A. I was then asked to keep myself informed as to the progress of the work, and to give such advice as I might see fit, or as was asked for, to Mr. Frost and to the council, and also to verify the propriety of the monthly payments, and to countersign the certificates for those payments; and for that purpose I made it my business to go over the whole work; to go up there every month, and satisfy myself as I thought best as to the accuracy of the certificates for the payments.

Q. Did you make a personal examination monthly, or oftener?

A. I didn't go over the whole work every month on the ground, but I was there often enough to keep well informed as to its progress; and whenever anything new occurred at any point, I made it a point to visit it as soon as possible. I was there during the first two years an average of two or three times a month; sometimes a week at a time; after the first two years, about once a month. I was acting as consulting engineer four years in all,—from February, 1871, to 1875.

Q. In your personal visits to the Tunnel, did you find either of the Shanlys there?

A. I frequently met them there.

Q. Did you exchange views with them in relation to the work, and the manner of carrying it on?

A. I oftentimes met them at the hotel where I stopped, and often asked them as to how they were getting on, and what their plans were; but I didn't consider it part of my duty to advise them what to do at all.

Q. Your duties were with Mr. Frost?

A. Mr. Frost and the council.

Q. Do you know how often the Tunnel committee of the council made personal examination of the work?

A. I think they made it a rule to go up there every six months. The whole council nominally went, usually, once a year. Every member of the council didn't always go, but they were expected to; that is, they made it a rule to, and the committee went oftener. Sometimes twice between the yearly visits; generally once, if not twice.

Q. Did individual members of the committee go when the committee did not go as a body?

A. Yes, sir. Sometimes when there was anything special calling for their attention, one member of the committee would go up and report. I have often known that.

Q. How soon after your duties commenced there as consulting engineer, did you observe anything in the manner of the conduct of the work which didn't meet your approbation as to the mode of making progress?

A. I think in the spring of 1871, very early after my appointment; in fact, perhaps, in February, I had some conversation with Mr. Shanly as to his plans at that time, and I reported the matter to the governor and council, with such advice as I thought best.

Q. Have you that letter?

A. I have the whole correspondence; that is, all my own letters.

Q. I wish you would turn to that first report which you made, and read so much of it as will explain the then mode in which the Messrs. Shanly were carrying on the work, and your objections, and what you thought they ought to do?

Letter read from Mr. Philbrick, to the governor and council, dated February 17, 1871, as follows:

Boston, February 17, 1871.

To His Excellency WM. CLAFLIN, *Governor, and the Honorable Council.*

During a conversation with Mr. Shanly early in this month, he informed me that he was making no preparations for working pneumatic drills at the east heading at the central shaft of the Hoosac Tunnel, and that his plan was to work that heading entirely by hand.

I find, on referring to his contract, that he agreed to the following in relation to the central section, viz.:

"They shall, before June 1, 1870, furnish and set in place the additional machinery, compressors, etc., requisite to maintain in the power-pipe a constant pressure of fifty pounds per square inch while supplying in each heading the continuous working of eight pneumatic drills, and also provide requisite air-pumps, etc., etc.

"They shall employ suitable force, and shall maintain, after June 1, 1870, an average rate of monthly progress of Tunnel excavated to full size, east and west, of not less than 80 feet in each direction."

Mr. Shanly may justify his omission by urging his present rate of progress in the eastern and western sections, as being about ten per cent. above the rates required in the contract, tending perhaps, in his view, to render the employment of pneumatic drills eastward from the central shaft, as unnecessary.

Whether this is *sufficient* reason for such change of plan, I cannot yet satisfy myself, nor shall I be able to do so until further time shall prove what rate of progress he is likely to maintain both with and without the power-drills in these shaft-works.



At present, however, it may be well to regard the fact that on February 1, he had only excavated the equivalent of 140 feet of full-sized Tunnel at the central section, while the contract stipulates that on that date he should have completed eight months' work at 160 feet per month, or 1,280 feet in length, showing the work to be 1,280, less 140, *i. e.*, 1,140 feet of length in arrears at this point. The average rate of progress during the year 1870 of the heading at the eastern section was, as I am informed by Mr. Frost,  $1,514 \text{ ft} \div 12 \text{ mos.} = 126\frac{1}{3} \text{ feet}$ ; *i. e.*, but 14 feet in the year above the rate of 125 feet per month specified in the contract; while at the west section the whole advance of heading was 1,203 feet, just 3 feet in the year above the specified rate of 100 feet per month.

Of course it is to be hoped that the present rates of progress, about 10 per cent. above these averages, can be maintained without interruption; but considering the uncertainty of such a result, under the many risks of such undertakings, it certainly does not appear advisable for the Commonwealth to waive the right of enforcing the terms of the contract, whenever they see fit. Whether or not any action should be taken at present, or till a few months more shall give more definite data for estimating the probable result of Mr. Shanly's plans, depends chiefly, as it seems to me, upon the question whether silence on the part of the Commonwealth could be construed as waiving the right to enforce this part of the contract whenever it seems advisable; this being a legal question upon which others are more competent to decide than myself. Wishing to present all the facts as near as I can ascertain them,

I remain, your obedient servant,

EDWARD S. PHILBRICK,  
*Consulting Engineer, etc.*

Q. When next did you have any correspondence on this subject?

A. I had some further correspondence with Mr. Frost upon matters of minor importance in the next few months. I wrote to Mr. Frost on the 30th of May on that same question, and also wrote to Mr. Crowell, who was the active member of the council committee, on the 30th of May on the same subject—working eastward by power from the central shaft. I wrote to Mr. Crowell on the 30th of May, 1871, as follows:

Boston, May 30, 1871.

Hon. H. G. CROWELL:

DEAR SIR,—I inclose herewith a short statement, showing condition of the work at the Hoosac Tunnel on the 1st of May, 1871.

The delay in the work at central shaft at different times and from different causes, has, as you see, left the contractors considerably behind their contract in the stage of advancement. On this account it seemed to me that the Commonwealth should now insist upon having pneumatic drills applied eastward from the central shaft, as agreed upon; for although the eastern headings may be joined without their aid, consider-

ably in advance of the western, the early joining of these eastern headings will materially hasten the work beyond, by enabling the water and rock to be taken out through the eastern portal, abandoning the central shaft, except for ventilation, at as early a day as possible.

Very truly, your ob't serv't.

EDW'D S. PHILBRICK, *Consulting Engineer.*

*Statement showing Condition of the Work at the Hoosac Tunnel May 1, 1871.*

	Length of heading pierced since July 1, 1869.	Length required by contract.	Difference.
East end, . . . . .	2,890 feet.	2,750 feet.	+140 feet.
Central section, eastward, . . . . .	133 "	880 "	-747 "
Central section, westward, . . . . .	202 "	880 "	-678 "
West end, . . . . .	2,078 "	2,200 "	-122 "
Totals, . . . . .	5,303 feet.	6,710 feet.	-1,407 feet.

*Length of Heading to be pierced May 1, 1871.*

	As now found.	If contract had been carried out as per schedule.
East of Central Shaft, . . . . .	4,129 feet.	3,522 feet.
West of Central Shaft, . . . . .	5,856 "	5,056 "
Total, . . . . .	9,985 feet.	8,578 feet.
Showing difference of 1,407 as above.		

A considerable amount of work has been done on "heading enlargement" at the east end, in advance of the requirements of the contract; but as there was plenty of time to complete this work before the completion of the headings, or at least to such an extent as to *overtake* the headings, this can in no way compensate or be offset against the omission to pierce the headings at the rate agreed upon, which necessarily governs the time of the completion of the whole work.

EDW'D S. PHILBRICK, *Consulting Engineer.*

The next day, June 1, 1871, I wrote to Mr. Frost, speaking of having written this letter, in a little different language, but I don't know that there were any new points up. I will read the letter. [Letter read.]

Q. (By Mr. ALLEN.) Those letters were not shown to Mr. Shanly?

A. I don't know that they were. I had no official duties with Mr. Shanly at any time. I wrote again to Mr. Crowell, as the executive committee upon the Tunnel, on the 30th of May, 1871. I wrote two letters to him on that day, and this is the second one.

BOSTON, May 30, 1871.

Hon. H. G. CROWELL, *Executive Council*:

DEAR SIR,—On the 17th February last, I had the honor to address the governor and council a letter, from which I make the following extract, viz.:

"During a conversation with Mr. Shanly, early this month, he informed me that he was making no preparations for working pneumatic drills in the east heading at the central shaft of the Hoosac Tunnel, and that his plan was to work that heading entirely by hand, etc."

The many delays from various mishaps, and the present delay of over two months at the central shaft, should teach us that we cannot safely reckon on an uninterrupted progress at that point. In fact these repeated delays threaten to defeat the completion of the whole work within the time specified, unless every possible point is pushed. It therefore seems to me important that while we work through this deep shaft at all, the work should be pushed with *all possible vigor*, and that, at least, all the apparatus should be applied which was contemplated in the contract, and which can be efficiently worked, in order to *get rid* of the shaft as a means of exit at the earliest possible moment.

I am aware that the eastern mass of the mountain can be pierced earlier than the western mass, even if the eastern heading from the shaft be worked merely by hand-drills, and the contractors may hence argue this point as of minor importance. But the moment this eastern mass is pierced, we are *no longer dependent* upon this deep shaft and all its uncertainties.

We can *abandon the pumps at once*, and if found best, or in the event of accident in the hoisting apparatus, we can dispose of the material from the western heading by running it out through the east portal.

A considerable saving of time can in this way, doubtless, be effected in the final completion of the work, and as this application of power *both ways* from the bottom of the shaft was distinctly provided for in the contract, I see no good reason for omitting it longer.

Very respectfully, yours, etc.,

EDWD S. PHILBRICK, *Consulting Engineer, etc.*

P. S.—Apparatus is already provided for working power-drills in *one* direction from the shaft. What I wish to urge is applying it *both ways*, as specified in contract.

E. S. P.

Q. Won't you state which way it was provided in the contract?

A. To work both ways. That is all I have in this letter-book. That was the first of June. Very shortly after he met water working westward, as has before been shown, and from that time forward his plans were apparently changed.

Q. (By Mr. TRAIN.) Changed, how?

A. That is, he applied his machinery with all possible vigor eastward, and didn't push westward with such vigor as I supposed the contract required.

Q. He didn't do anything westward, did he?

A. Well, he spent the succeeding six months after striking this water in getting in a pump.

Q. Which pump did he put in at that time?

A. He put in the only large pump he had.

Q. Why was he so long putting in the pump, do you know? Was there any occasion for his being six months about it?

A. He met with various delays, which showed to me that the work had not been thoroughly foreseen and planned. He had apparently not expected water, and hadn't planned for its removal. That was a matter of surprise to me, as I find I stated to the council, that he had made no definite plans for the removal of water before he found it. It would have cost but little to have made plans and have studied up the subject. I can't say distinctly that he had not made such plans, but they didn't appear to have been made, from the delay which occurred in the progress of the work. I couldn't conceive of any other reason for such delay.

Q. You mean to say that he had made no preparation for water at all; hadn't anticipated apparently any considerable amount of water?

A. No considerable amount of water; no preparation that I could see. What he had figured on in his office, of course, I can't tell, but no ostensible preparation.

Q. What occurred next?

A. Then occurred the six months' delay. The pumps were not in efficient working order until the late autumn, and the progress made at that time has been pretty well indicated in the testimony already given. As soon as he got them in efficient condition, he went to work with the pumps, and they continued at work until they were flooded again.

Q. You say he put in one pump. What other pumps were there that he used?

A. He put in two pumps. He put in an 11-inch pump and a 7½-inch pump at the other end of the shaft, both worked with the same engine.

Q. Would it have taken any more time to have put in two large pumps than it did to do what he did?

A. I think two large pumps might have been put in in three months as well as one in six months, if the work had been planned beforehand.

Q. Did subsequent experience demonstrate that two large pumps would have been sufficient to keep that shaft free?

A. It did. I took pains to ascertain the maximum flow of water before the junction of the western headings in November, 1873.



Q. Won't you go on now, in your own way, and give your views in relation to this branch of the inquiry?

A. It always appeared to me that the Commonwealth had so much at stake in that shaft, having expended half a million dollars in sinking it, that every effort should be made by the Commonwealth to reap the advantage of it by requiring the contractors to do everything they had agreed to do at that point. The only real value of the shaft, as I regarded it, was to hasten the completion of the Tunnel by affording two other points of attack. Not only had the Commonwealth been subject to the cost of the Tunnel itself, but there was \$40,000 a month interest rolling up all the time upon the previous outlay and probable outlay to completion. But I represented to the council repeatedly during the first year,—not in writing, I have no record of it, but I am confident, I remember positively the fact, that I did it verbally in the council chamber when I was called upon there for conference,—I represented to them that it was very important that pumping-power should be supplied there in advance; that there should always be a margin of pumping apparatus above the apparent want; that they were piercing wet rock; that the rock which they were piercing in the same ledge from the west end was also wet rock; that the mass of the mountain, where we had tapped it on both sides, appeared to differ materially from the eastern mountain—the latter mountain was comparatively dry; that having pierced over a mile from the west end, we had got into a mass of rock which was almost precisely similar to that which we had worked from the central shaft, in its general characteristics of seaminess and wetness; that we had every reason to suppose that similar rock lay the whole distance between those points, and that if that shaft was to be used, it ought to be used with the greatest possible vigor in order that the Commonwealth should reap the advantages of it; that unless pumping appliances were built in advance of the influx of water, continual and vexatious delays would be occasioned by waiting for machinery after the water came in, without adequate means of handling the water, as the result proved afterwards. The actual facts as to the greatest flow of water I took pains to ascertain long after they had done pumping—after the necessity of pumping had ceased. The heading from the central shaft kept on working westward, and the week before it joined the western heading,—namely, the 20th of November, 1873,—I got the greatest flow of water there. I have here a record which I copied from Mr. Wederkinch's book. He was the assistant in charge of that work, and gauged the flow of water repeatedly. That record has already been brought up to a certain point, and exhibited here. I have it later. I have considered it an important point to find out how much water ever ran

from that gallery before they connected it with the western heading, and I asked Mr. Wederkinch for the maximum flow,—the greatest flow he ever found there,—and he showed me these figures in his book. The flow east at the central shaft, before the meeting on the 27th of November, 1873, measured on the 20th November, was 320 gallons a minute. I asked him if he had ever found any greater flow than that at any time, and he said for a few minutes, perhaps for half an hour, there might have been an influx from a newly-cut seam or pocket, but that the flow, taking it for a whole day, never could have gone beyond this point; so that, if they had had pumps competent to lift 300 gallons a minute, or even less, they would have been able to handle all that water without serious inconvenience up to the time of drainage.

*Q.* (By Mr. PRATT.) Was it reasonable to suppose that there would be any more water than had been found?

*A.* I have considered it reasonable to expect a very large amount of water. The only means I had of judging was by the working from the west end in similar rock, where the rock was of the same geological character and bearing wet seams. There was considerable water coming in all through that part of the work, and I considered that the only criterion I had to judge of the probable flow working west from the shaft. The result showed that one more pump like the one he had in would have taken out the whole of it, with a margin.

*Q.* Was there any reason to suppose, then, that one pump would have done it?

*A.* I should have considered it a proper thing for any one who had agreed to push that work, as Mr. Shanly did, to have kept his machinery a little ahead of the demand, and always to have had a margin of power, not only for contingencies that might arise, but for economy's sake. Heavy pumps can never be worked up to their full capacity with economy, nor without great risk, when run constantly night and day without intermission. I should have considered it the proper thing to have always had a surplus of power ahead, until I got very near the point of drainage.

*Q.* It is supposed that another pump, if put in there, would not have worked more than a month or two, perhaps. Would it have been very judicious to put in another pump under those circumstances?

*A.* I say, I would have had a surplus of power until I got near the point of drainage. Of course, a month or two would have been occupied in putting in the engine, and he could not have accomplished anything.

*Q.* (By Mr. TRAIN.) Taking that as the criterion of what

would occur in the central shaft, you think preparations ought to have been made for a larger amount of water than was subsequently found?

A. The great bulk of the water at the west-shaft workings came in between the west shaft and the portal, while they were working that rotten rock, which was full of water; but inside the west shaft, between the west shaft and the central, the rock was all more or less wet. There were intervals of dry rock several hundred feet at a time, and then wet seams, but they all had that character as distinguishing it from the dry rock east of the central shaft.

Q. (By Mr. ALLEN.) Was the water which ran out measured at the west end?

A. Yes, sir, it was measured the same day, November 20, 1873. It was 930 gallons a minute then. That didn't include much of the water in the demoralized rock; most of that was drained off outside the arch, I suppose.

Q. What did it cover?

A. It covered all the water there was found running out of the west portal. I mean, it didn't include that flow of water which the parties making the Tunnel between the west portal and the west shaft encountered during the construction, because that had either been stopped off by building the arch, or found drainage underneath. There were 930 gallons running west before joining the headings. Now, of course, it all runs west from the central shaft.

Q. (By Mr. TRAIN.) When next did you call attention to the fact that they were deficient in pumping-power?

A. As soon as I found that they were not providing another large pump.

Q. When was that?

A. Well, I wrote some letters of which I gave you copies. I have forgotten the dates now. I had a conversation, however, with the council previous to this, and they repeatedly told me that it was hardly the thing for the Commonwealth to undertake to dictate to Mr. Shanly when he should put in a pump; that it was incumbent upon the Commonwealth to dictate that he should make such and such progress, and he must provide the means for doing it in his own way. After having had several such conversations with the council, or committee of the council, as to the propriety of putting in more pumps, preparing pumps in advance of the water, I thought it proper to write a letter, and put my ideas upon record, which I did as late as June 13, 1872.

JUNE 13, 1872.

*To the Governor and Council :*

Having just returned from a visit to the Hoosac Tunnel, it becomes my duty to inform you of the condition of the work, which is far from satisfactory at the central shaft. The work in advancing the western heading, which was resumed on the 12th of May, was interrupted on the 22d by influx of additional water through seams then first pierced. The whole flow into the shaft and its galleries is now estimated at 215 gallons per minute. The large pump is able to lift about 160 gallons, and the small one, now just enlarged, promises to lift some 50 to 60 gallons more, which, if successful, will just about be able to keep out the present influx, with no margin for delays or mishaps of any kind. There is at present an accumulation of some six feet depth of water in the bottom, which will require the united efforts of both pumps and the hoisting apparatus to lift for some eight to ten days in order to clear the Tunnel. As the advance of the last fourteen feet westward brought in a new flow of about 100 gallons per minute, and as the larger pump is equal to the lifting of only some 160 gallons, it is evidently useless to think of resuming work at that heading without an additional pump of at least as great a capacity. No preparation is made upon the ground, or anywhere else that I can learn, to apply such machinery. If the rock continue to discharge such quantities of new water during our next advance, when made, as it has during the recent advance, even a new pump of the same capacity as the large one now at work would not enable us to advance more than a few weeks.

Of course the condition of that rock cannot be ascertained before piercing it, and after piercing it, it will be next to impossible to check the flow from the newly-cut seams. The question is, then, squarely before us, whether the contractors are to be held to the prosecution of their work according to the terms of their contract at any future time. Their delay in providing the pumps will render it impossible now to so prosecute it until the pumps shall be provided, and as one or two months must necessarily be spent in erecting such pumps, the work of mining westward must necessarily wait. The prospects of draining the shaft are good about February 1, 1873, say  $7\frac{1}{2}$  months ahead, but not sooner. If new pumps be erected in 6 weeks, there then remains some 6 months before February, 1873, in which to work them to advantage; and if they are not overtaxed by new water, their application would probably allow an advance of some 600 feet westward, thereby hastening the completion of the whole work about  $2\frac{1}{2}$  months, but, if overtaxed in the meantime by new water, the mining would stop again, and their usefulness would thus be diminished accordingly.

I have signed the estimates for work done in May to signify my satisfaction of their accuracy, as regards the computations and representations of work actually done up to June 1. But I wish to protest against a continuance of the payment of such sums to the contractors unless they perform their part of the contract. It now becomes evident that they will not be able to finish the work as they agreed, owing to the influx of water, for which they made no provision.



It does not seem to be proper that the State should continue to pay for what she does not receive. The sum agreed upon, to be paid on completion of the work, was on the supposition that the work was to be completed at a certain time. If it is not then completed, the State will not receive the stipulated equivalent for its outlay, and especially so long as the contractors neglect to take steps to insure its completion as agreed which a reasonable foresight would demand, it does not appear to me to be equitable that they should be paid as if they had so done. Possibly this question may be deferred till the completion of the work, or till the expiration of the time named in the contract for its completion, without detriment to the State's interests.

Of that you will be better able to judge than myself, but I wish the facts to be fully understood, and do not wish to further sanction the payment of funds which may not be justly earned.

Respectfully, your obedient servant,

EDW. S. PHILBRICK, *Consulting Engineer.*

Q. What followed the order of Mr. Frost of March 2, 1872, on the part of the contractors?

A. They were interrupted in May. They went on enlarging westward from the central shaft at that time, but working from the bottom instead of the top; their previous heading had been on top. Then they represented that it would be better to change from the top to the bottom, and they were allowed to do so. They went on the next three months, up to the early part of May, until the enlargement had caught up with the heading, and then they began to pierce new ground, and then immediately pierced more water, which overpowered their pumps, and stopped work at that point until they got drainage.

Q. Can you give the monthly rate of progress east and west from the central shaft made by the contractors?

A. It is on this record. The bottom of the shaft was reached in August, 1870. Beginning to work eastward in October, 1870, at station 12,821 (these figures count from the eastern portal), in the month of October, they reached point 12,817½; that was only 3½ feet; probably the last few days in the month. In the month of November, they attained the point 12,787; that is, about 30 feet. In the month of December, they reached the point 12,777; that is, 10 feet in the month. In the month of January, 1871, they attained the point 12,764; that was 13 feet. In the month of February, they attained the point 12,744; that was 20 feet in the month. In the month of March, they attained station 12,704; that was 40 feet that month. There was no more work done until July at that point. That was the time they were flooded out, and suspended work until

they could get rid of the water. They commenced in July, and worked up to station 12,699; that was 5 feet for the month of July. It was only the last few days. In August, 1871, they attained station 12,668; that is, 31 feet. In the month of September, they attained station 12,641; that was, 27 feet. They don't seem to have done anything in October there. There is no record of it. In November, 1871, they attained station 12,587; 54 feet. I think at that point they began to get their steam-power going,—the compressed air-drills,—because the progress increased; and in the month of December, they attained station 12,500; they got 87 feet in that month. That was the first month they attained the contract rate of progress at that point. In January, 1872, they had got to station 12,413; that is, 87 feet. In February, they attained station 12,320; that is, 93 feet. In March, 1872, they attained station 12,220; that was just 100 feet. But it was half of it outside the lines, above the lines. In April, 1872, they attained station 12,122; that was 98 feet. In May, they attained station 12,029. In June, they attained station 11,927. The progress was pretty regular along here. In July, they attained station 11,818. In August, 11,709. In September, 11,604. In October, 11,472; that was 132 feet. At that time they came within hearing of the other party, and got excited and worked the best they knew how. In November, 1872, they attained to station 11,324. In December, they joined the eastern headings. Part of the time they worked on the enlargement, but they didn't begin work on the enlargement seriously until after the junction of those headings. The enlargement was hindered by constant interruptions of water down there. The water would flow on a lower level, and it would not interfere up here; but any temporary obstruction of the pump, any repairing, would cause the water to accumulate some feet deep in this bottom gallery, and make a pool. When they got to work again, they could overtake it perhaps, but it prevented pursuing any continuous work on the bottom until they got it finished.

Q. Now, can you give us a table showing their progress excavating to full size eastward?

A. They didn't get any full size until after they got this eastward junction. As I say, they didn't prosecute that enlargement until after they got the headings joined. They got as far in February, 1871, as station 12,959, which is only about 50 feet east of the shaft. Then water came in, and they waited there a whole year.

Q. Now, let me know the rate of progress westward?

A. Beginning westward in the same month, October, 1870 (the figures count there from the west portal,—a new series of figures; I am going west from the central shaft), the starting-point at the

edge of the shaft is station 12,178. In the month of October, they reached station 12,168; 10 feet. In November, they reached station 12,123; that is, some 45 feet. In December, they reached station 12,107; that is, only 16 feet. In January, 1871, they reached station 12,075; 32 feet. In February, they reached station 12,036; 39 feet. March, 1871, they reached station 11,992; 42 feet. There was an interruption from March to December. In December, they reached station 11,954; 38 feet. In January, 1872, they reached station 11,890; 64 feet. In February, 1872, they reached station 11,869; 21 feet. There was a delay of 10 months at that point. Then it became enlargement, and the heading was prosecuted afterwards on the bottom; and the first advance they made beyond that point was in May, 1872, when they got up to station 11,855, 14 feet ahead of the point reached in February. There they waited until December before they made any further advance, waiting for drainage and pumps to pump over the breast. In December, they reached station 11,835; 20 feet. They kept right on in January, pumping over the breast then. I rather think the delay was between May and December for the drainage. This 20 feet advance in December was after they got drainage; the last few days of the month, in all probability. In January, 1873 (beyond that they went ahead fast enough), they attained station 11,691; 144 feet. In February, they reached station 11,551; 140 feet. In March, they reached station 11,396. In April, station 11,233. In May, station 11,078. In June, station 10,947. In July, station 10,796. In August, station 10,638. In September, station 10,454. In October, station 10,284. November 27, they joined the headings. This was a heading progress of about 8 feet. There was no enlargement done until after they got the drainage. The enlargement west commenced in April, 1874, on the bottom. They did some enlargement in July, 1873, on the top. That is the earliest I can find west of the shaft. They jumped into a new place and worked east. They jumped into a place 200 or 300 feet west of the shaft, and worked east, because the rock favored that direction.

Q. Well, they did not commence to enlarge until after the time limited by the contract had expired?

A. The enlargement west of the shaft they commenced in July, 1873, and their contract was to complete the work in March, 1874.

Q. Yes, I know; but they were enlarging in April, 1874; they did not get through with it until April, did they?

A. They did not get through until some time after that; they did not get through until June, 1874.

Q. I understand you to say, that, in your opinion, there was no



difficulty in their having complied with the provisions of the contract, if they had chosen to put in proper pumping-power?

A. No difficulty, but the expense.

Q. In that case, would they have been able to complete the Tunnel within the time limited by the contract?

A. I think, if they had had an enlarged pumping-power to start with, they could.

Q. When I say the time limited by the contract, I mean not the extension, but the original contract, March, 1874?

A. That is what I supposed.

Q. Now, I want to inquire of you about this working above the lines?

A. They worked above the lines for several months east of the central shaft,—eight or nine months, between the 1st of February, 1872, and October.

Q. Did they get any compensation for that?

A. Not that I know of. I don't suppose they were entitled to any. They did it contrary to orders,—contrary to the wishes of the engineering department.

Q. How, and why?

A. I could never see any good reason why. The Tunnel runs down grade at that point, from the shaft eastward, and they were working on top; there was a little water trickling in, but not more than one man could bale; they would have had no trouble in taking care of that. They worked along on a level, so as to let it run back, and, as the grade ran down, they soon got their headings three or four feet above the proper roof; but in the latter part of September, 1872, they began to work down fast enough, by putting in a common hand-pump, when one man, working two or three hours a day, kept the water down without any trouble. I don't know any good reason why that pump should not have been put in four or five months previous; and then they could have pumped the water up four or five feet into a spout, and had it run back to the shaft. They were shown every week where the grade was.

Q. Well, all that time and expense were lost to the contractors and to the State?

A. Of course. Well, they pierced the rock just as fast as they would if they had kept lower; but there was considerable expense incurred by the contractors, which was entirely unnecessary, for removing the material taken down outside the lines.

Q. How was it removed?

A. Hoisted up the shaft, finally. At the time, it was dumped into the pit there,—dumped into the water, and handled over again after they got the water out.



Q. Does that give any extra size Tunnel, that is of any value, to the State? If I understand Mr. Allen, he claims that if they have made the Tunnel larger than the contract calls for, that ought to be considered?

A. It is of no value, unless enlargement for arching should happen to be made at that point. I don't recollect of any very bad roof at those points. I believe that roof is pretty firm.

Q. Mr. Shanly, in his statement, says that the character of the rock changed at the central shaft from what it had been supposed to be, and what it had been represented to him to be; what was the fact about that?

A. It changed in its crystalline formation; it was a little more crystalline as they worked west, and more seamy. It was classed by the geologists, last summer, as mica-schist, but as a sub-division of mica-schist, which they called "granitoid gneiss"; while the eastern rock, which was drier, had more mica in it, and was less crystalline.

Q. I believe Mr. Shanly called it "wet granite"?

MR. ALLEN. When?

MR. TRAIN. Didn't he?

MR. ALLEN. I don't remember his saying anything about it this year. We had some talk about it last year.

WITNESS. It had the appearance of granite, because it was more crystalline; but it carried more water,—there is no mistake about that. Its chief difference, so far as working it was concerned, was its seaminess, carrying seams connected with the surface, and in its crystalline character, which made it a little harder to drill.

Q. Is there anything else that occurs to you, Mr. Philbrick, in connection with this matter of water and pumping, and the central-shaft progress, which I have not inquired about? If there is, I wish you would state it. I don't want to come back to it again, if I can avoid it.

A. I don't recollect anything now.

Q. You have said that there was no propriety in working outside and above the lines; was that made a subject of communication to the Shanlys?

A. I know that the grades were given every week of the work, and I understood Mr. Frost that diagrams were given Mr. Shanly every month, showing the exact position.

Q. Now, this is as good a place as any for inquiring how this matter of prosecuting the work affected the estimates for the monthly compensation of the contractor?

A. No payments were made to him for what he worked outside the lines. We were not authorized to pay him for rock that he got

out outside the lines, so that he worked to great disadvantage during those months in not getting ready money for his work.

*Q.* Well, he did not keep up his Tunnel enlargement; how did that affect his estimates?

*A.* Of course, the heading was much more expensive per yard,—I mean than enlargement,—very much more expensive; and as the enlargement was not in progress, he did not get the advantage of the average price. The contract made no provision for extra pay for work on the headings, as distinguished from enlargement (he was expected to carry on the heading and enlargement at the same time). The contract did not authorize us to make any distinction in price in the estimates between heading and enlargement, and did not authorize us to advance any money for taking out rock which we considered unnecessary, outside the lines.

*Q.* Can you state at what point of time, in your opinion, these pumps should have been provided?

*A.* Why, they should have been provided before the water was met, in order to have been efficient to overcome the difficulty.

*Q.* I want to get your judgment as an engineer. Suppose you had been in charge, how long before that time should you have provided additional pumping-power?

*A.* I think, if I had had charge of it, I should have planned the pumps, and had them reduced to definite form, on paper, before I began to work either way from the shaft.

*Q.* There was plenty of room in the central shaft, as I understand it, for all the pumping-power that would have been necessary?

*A.* There was ample room. The shaft was 27 feet long by 15 wide. [Witness drew a diagram, showing the shape of the shaft, and the points at which the pumps were placed.] I cannot see any reason why a large pump should not have been put where the small one was, as well as at the other side of the shaft. The small one took up nearly as much room as a large one would.

*Q.* Was there any time lost in getting the proper foundation for this pump?

*A.* Yes, there were some months lost, not in preparing a foundation for this work inside the Tunnel, but in the shaft-house, for the gearing which drove this pump. The work in the shaft-house had been constructed by the State previous to the contract. The foundation had been put in there for a small engine to drive the pump of the capacity which was working there, but it was made of small stone, such as were found on the ground, and was inadequate to stand the shocks of the heavier machinery required to drive the large pump, and the foundation yielded so that the bed-plates broke, I understand, and that occasioned delay. It was nothing inside the

Tunnel; it was the foundation of something in the shaft-house, up top, in daylight. The engine was a horizontal stationary engine, which had been put in by the State, of some sixty horse-power, years previous, and it had never had any interruption of any kind until after the large pump was put in. The amount of water met with at that point was very inconsiderable. The engine was used to drive this little pump which they first put in; it was a small matter for that engine to do, but the engine was fully taxed after the large pump was put in, and the gearing which connected the work with the engine, which stood away off in a separate building, with the connecting rod of that pump, was planted on one side of the shaft, on the rock, with a foundation built on the rock, which was found to be built of small stone, and was not strong enough for the purpose, and the Shanlys afterwards got some slabs of granite or marble to cover it with, and give a proper foundation to the gearing.

Q. Now, was there any reason why he could not have worked the heading and enlargement while putting in his pumps?

A. Yes; while putting in the pump,—I mean, if he waited until after the water had obliged him to put in the pump,—the hoisting apparatus would have been a good deal delayed by having to hoist the water. That was the actual state of the case, because he never attempted to put in a pump until after the water had come in beyond the capacity of his pumping-power; but if the pumping force had been provided in advance, the headings might have been driven. I won't say the enlargement could, because he was not far enough ahead to drive the enlargement, independent of the headings. At the time the water was encountered, there was no room for the necessary enlargement. The headings had not progressed far enough from the shaft to give room for the separate gangs, and they could not commence enlarging until after the headings had got out of the way, so that the gangs would not interfere with each other. I think the headings on top could have been prosecuted, if they had had pumping-power provided in time to keep the water out.

Q. In the exercise of the judgment which you say you should have exercised if you had been doing that work, as to the time of putting in pumps, he could have arranged the work so as to have carried forward his headings and enlargement, and put in his pumps at the same time?

A. Not the enlargement, because there was no room to do it. The headings could have been pressed, I think, without much interruption, because, if the hoisting machinery was interrupted, as of course it would be during the putting in of the pump by lowering the apparatus of the pump, handling it, and waiting and attending

on the machinists, the rock might have been dumped below. There was room enough below to dispose of considerable rock, to be hoisted afterwards, as was actually done, in fact.

Q. Do you know how much personal supervision Mr. Shanly gave to this work?

A. I know he was there occasionally. I met him there in person on the ground when I was there, in the Tunnel and outside, and I met him in the hotel frequently. I never had any intercourse with his foremen at all; had no occasion to.

Q. Were you present at the time the settlement was made in December last?

A. I was, at the time the settlement was arranged. I was not there at the time the money was paid.

Q. Was Mr. Shanly present himself?

A. Yes.

Q. And the Tunnel committee?

A. Some of them. Governor Talbot was there.

Q. Now, I wish you would take that schedule, and follow it through, and state the results to which you came, and the grounds why?

A. Well, the results are very much more fully stated in this report of the Tunnel committee than I can state them.

The first item is, "Enlarging Tunnel first 800 feet from east portal." It was claimed that that enlargement was represented to have been finished when the contract was taken and signed. I understood that the claim was disallowed because of the last clause of the contract, which provides that any errors or omissions in the estimates shall not be taken to govern the general amount to be paid, or something of that kind. That was claimed to be an omission or misrepresentation, through inadvertence or otherwise of the state of facts at the time the contract was signed.

Q. Claimed by Mr. Shanly?

A. Yes, sir; that representations had been made to him that the Tunnel was finished for 800 feet, whereas it was found not to be finished. I believe that is the whole, on that point.

Second: "Grading embankments at east end." The contract provided that he should dispose of the material within certain limits of length, as directed. Directions were given to dispose of it in a certain manner, by certain stakes set. He disposed of it above the proper level. I saw the stakes there myself repeatedly, and inquired why he was running above them and burying them up. I always regarded it as his own risk.

Q. What answer was made to you?

A. That they supposed it might settle, or something of that



kind. I don't know that I ever asked Mr. Shanly; I asked Mr. Frost.

Q. Did you ask his superintendent there?

A. No, I never had any communication with the superintendent.

Third: "Making central drain, 5,017 feet from east portal." I understood that to be considered in the same light as the first item—as an error in the representations in the schedule. It was considered to belong to the same class of claims.

Q. Mr. Shanly made the same claim as to that item that he did as to item 1, and it was rejected for the same reason?

A. Yes, sir; the committee of the council asked my opinion as to each of these items; I don't remember whether they were presented in the same order as they are here, but the subject-matter was, and something more, which was allowed.

The fourth item is for "Increased working expenses because of the destruction of the Haupt Tunnel." My opinion was asked upon that, as to the equity of the claim, the justice of it, and my reply was, I did not see how the contractor could have any equitable claim for the use of the Haupt Tunnel after the termination of the time within which he had agreed to finish the whole work, namely, March, 1874. I knew the Haupt Tunnel was interrupted in February, 1874, or the latter part of January, about six weeks previous to the expiration of the time of Mr. Shanly's contract, March 1, 1874. After March 1, I stated that I did not see how any claim could arise, unless they had agreed to extend all the facilities which they had at first undertaken to give for the execution of the work.

Q. Well, your idea was, that if they had prosecuted their work properly, and complied with the contract, it would have been done in time, and the destruction of the Haupt Tunnel would have involved no loss to them?

A. I understood then that it would have involved no loss. That is, I understood at that time that the Haupt Tunnel was not interrupted until after March 1, but afterwards I was informed that it was interrupted during a period of six weeks previous to March, and I think there may have been some inconvenience to Mr. Shanly during that period of six weeks; but I know the Haupt Tunnel was idle for many months previous to that time, nothing going through it, and a large amount of rock might have been taken out, and which I urged Mr. Frost to have taken out, because I knew it would be in the way at a time when we should be in a hurry; namely, the first thousand feet east of the west shaft was left until the last few months of last summer.

Fifth: "Taking down loose rock after Tunnel had been trimmed." That was for rendering the Tunnel safe for use. I con-

sidered it indispensable to the use of the Tunnel to have the loose rock taken off, such as it would be unsafe to run under. It has always been my practice in other work to require of all contractors to leave their rock-cuttings in a safe condition. After working them out to full size, I have required them to examine them for safety, and it has always been done where I have had anything to do with work before.

*Q.* Well, it was done after a fashion, wasn't it?

*A.* There was a certain amount of work done, but not thoroughly, at any point. I was asked by Governor Talbot to visit the Tunnel during the progress of that class of work last summer, and did so, and gave it my personal attention. Mr. Shanly had claimed that there had been an unnecessary amount of work required of him in that respect, and Governor Talbot asked me to satisfy myself whether it was an unnecessary requirement, and let him know. I went up there and went on to the ground where one of his gangs were engaged in that work. They were on a stage, which was on wheels, running nearly the whole width of the Tunnel, so that they could reach the roof. I got up on it and asked them to run the stage back a few rods, where they had been working, and let me examine it. They did so, and I took a hammer in my own hands and sounded the roof, and found some large tracts of several yards which sounded hollow and unsafe. I asked them why they didn't take that down; they said they thought it would stand. This was the foreman of the gang who were at work there on the stage. I asked him if his superior had given any directions about such points as sounded hollow. He said that his superior had told him that such points as that he need not mind. I asked him to try it again, and see if he couldn't get it down without much trouble. He called a man with a sledge and hit it, and a mass of some tons came down on the stage. I came back and reported to Governor Talbot that I thought he was not requiring the work to be done so thoroughly as I should have required it to be done myself.

*Q.* Was this after the trimming had been done?

*A.* After the trimming to size had been done at that point. Trimming to size was still going on at other points.

*Q.* Have you any idea about the expense of that work, and whether it was done to advantage?

*A.* As far as I could judge, from the length of time I stayed there that day, they were doing it in a proper way; but when they first began, they did not have the apparatus that was necessary. The apparatus was not at liberty. They afterwards got the apparatus, the staging, and prosecuted it to better advantage, but

they never attained that degree of safety which I considered proper to fit the Tunnel for public use.

Q. Have you any idea what it would cost to put the Tunnel in a safe condition for public use in respect to taking down loose rock, irrespective of arching?

A. I told Governor Talbot it might cost \$10,000 and might cost \$20,000; it was a matter of experiment; but it might be limited between those figures, perhaps.

Q. The governor and council claimed more than a year ago that the arching came within the terms of the contract; subsequently the Messrs. Shanly were relieved from that. How much is Farren's contract for arching at present?

A. The amount of the appropriation; I do not know that it is limited in any other way.

Q. What is it going to cost to supply the arching which the governor and council in 1874 claimed was within the contract?

A. Well, they couldn't define it in 1874, and couldn't define, to-day, exactly how much will be necessary.

Q. When I say "claimed in 1874," I mean that the governor and council, by their construction of the contract, claimed that the arching that might be necessary, more or less, was to be done by the contractors. What is the probable cost of the arching which appears to be necessary to-day?

A. I have not had any official duties in the Tunnel for the last three months. I resigned last month, and in fact I have had nothing to do with the Farren contract, except to advise as to the drawing up of the contract.

Q. Have you any knowledge which will be useful to us as to the cost of putting the Tunnel into condition for use, excluding the arching?

A. Well, as I said before, I thought, when I last examined it, that it might take from \$10,000 to \$20,000 more labor in stripping unsafe rock from the roof.

Q. Is there anything left to be done of which the contractors were relieved?

A. I don't remember anything except for what they allowed compensation,—the laying of the track.

Q. Then the additional cost to the Commonwealth will be the expense of arching and the expense of \$10,000 or \$20,000 for taking care of loose rock to make the Tunnel safe?

A. Yes, sir, and I regard both those items as very indefinite. Sixth: "Clearing out Farren arch." That I understood to be the material brought in by the storm of October, 1869, and that it

rested upon the same merits as the other claims arising from the damage done by that storm.

Q. You advised the governor and council that it was one of the contingencies?

A. One of the contingencies arising out of that storm, and should be treated on the same principles as the other claims arising from the same source, which they had, previous to my employment, investigated. I was not employed on the work during that storm, nor for some months afterwards.

Seventh: "For errors in original measurements of Tunnel rock." I suppose that would be included in the same class of claims as item 1. That is covered by the last clause in the contract, whatever it is. I believe that it has been proved that the whole amount is actually less than originally represented.

Q. Why were those computations made at the time this contract was entered into necessarily indefinite?

A. Because the amount of arching was indefinite, and because at that time there had been no accurate measurements made of the exact amount of work done by the State and that was understood to be done immediately afterwards.

Q. (By Mr. ALLEN.) You don't mean that you had any understanding about it at the time, of course?

A. I was not employed upon the work at the time.

Q. The understanding you got was an understanding derived from what information you got afterwards?

A. Yes, sir.

Eighth: "Damages arising out of storm of 4th October, 1869"; that has already been referred to.

Ninth: "Loss of interest 1st September to 22d December, 1874." I think that claim was not considered at all by the council. I cannot recollect giving any opinion upon that. The same remark applies to the tenth item: "Interest paid State on advances from drawback."

Q. (By Mr. TRAIN). I want to know if there was any conversation between Mr. Shanly and you gentlemen at the time you were arranging this settlement in relation to this breaking down of the Haupt Tunnel to Mr. Shanly's injury, in which he admitted that he might have used the Haupt Tunnel during those months that it lay idle, to which you have referred?

A. I don't recollect his saying anything about that, but I think the fact must be admitted. I don't think that he would hesitate to admit that it did lie idle several months previous, when he might have used it, if he wished to.

Q. Now I wish to inquire of you, Mr. Philbrick, in relation to



the manner in which the trimming to size was done, whether that was done to good advantage or not?

A. Well, it began in a very desultory way, and it took a good while for the workmen who were engaged in it to learn how to do it right the first time going over the ground. They made several attempts at trimming, where it was found they had only half done it, and so they had to go over the ground again for want of thoroughness in doing it the first time. Of course it was a great deal cheaper to do it right the first time than to go over the same ground several times. The trimming extended over a period of some years.

Q. How much time did they lose in getting properly educated, so that it was properly done the first time?

A. I think it was several months, but when they got thoroughly educated, there was great difference in the different gangs; one gang got along much better than another. I imputed the difference to the difference of intelligence in the foremen.

Q. Have you any idea what pecuniary loss that subjected them to?

A. No, I cannot form any idea of that.

Q. Was there any reason why those embankments should have been built above grade, that you know of?

A. At the railroad embankment, certainly, there was no reason, for it was just as easy to keep the railroad embankment at one level as another, if the men paid attention to it. The embankment for the highway ran down a steep inclination, and could not have been built the first time at the proposed grade without taking some pains to check the cars in their approach to the end of the embankment.

Q. In the month of November, 1873, you certified to an estimate requiring a payment of \$80,000, which is claimed by Mr. Shanly to have been in excess of the estimates for the month of October by \$60,000, and as showing that he was entitled to a great deal of money that had been kept back. Can you explain how that was done?

A. It then came to my knowledge for the first time that there was in the detail estimates for the work on the central drain a lot of detail prices which were supposed to foot up to the contract prices when the work was finished—detail prices for the different parts of the drain work; and that the amount of work actually done upon a certain portion of that drain was capable of being fairly valued at considerably higher rates than it had been valued in previous estimates. Mr. Frost showed me a good reason for not having paid them at the time when the work was partly done. I have forgotten what that reason was, but it satisfied me at the

time; but as I saw no reason for any further delay, and as Mr. Shanly had represented an urgent need for the money and the justice of receiving it, I assented to it. There was another payment made that month on account of taking down loose rock outside the lines. That is the only payment that I know of which was based upon any work not described in the schedule. I would not have sanctioned that if I had not known that the schedule rates had, on account of the accident of his working faster from the ends than from the shaft, left the State with a large amount in hand, so that it was perfectly safe to make him such a payment, and as I considered that work of taking down loose rock outside the lines for safety's sake as part of his contract, I saw no impropriety in advancing him the money according to its cost to him, especially as there was a margin in the State's hands.

Q. He had drawn for cubic yards in the eastern and western sections at the low prices, instead of drawing for cubic yards taken out east and west from the central shaft at the high price?

A. Yes.

#### CROSS-EXAMINATION.

Q. (By Mr. ALLEN.) Even after paying that \$80,000, there was left at the time of settlement in December last an amount of \$456,000 to come to him, wasn't there, instead of \$350,000, as was provided in the Resolve of 1873?

A. I believe that something like that was the amount.

Q. This withholding of money from him, which was accidental, was nevertheless to a very considerable amount, so far as it deprived him of money that he had actually earned?

A. I did not conceive that he had earned it.

Q. The governor and council paid it in December?

A. That was on the completion of the work; I mean he had not earned it monthly, so that it could be included in the monthly payments. I could not see any means of forming an estimate of what he had earned, except what was provided in the contract.

Q. It did have the effect, nevertheless, of keeping him out of a larger amount than \$350,000.

A. It was a larger amount reserved, in fact, than \$350,000.

Q. And it was an amount that would be in the vicinity of \$170,000, in excess of that, until you made your extra allowance last fall?

A. Not all due to that cause.

Q. No; but there was an amount that would be about \$170,000, in excess of the \$350,000, that was withheld from him, wasn't there?

A. No.

Q. How much did you say you allowed him in October, in excess of his earnings of that month?

A. I considered that he had earned it all.

Q. Well, how much was allowed to him in excess of his earnings in that month?

A. Nothing.

Q. Did you consider that he had earned that \$60,000 that month?

A. A good part of it; I don't know how much of it; as I said before, it had not been brought to my notice.

Q. Didn't you know that the estimate on which you gave him \$80,000 showed that only about \$20,000 had been earned that month?

A. Earned in other items; a great deal of the work for that \$80,000 was done that month, how much of it I don't know.

Q. Didn't you consider, when you allowed him that \$80,000, that you were making him an allowance for work that had not been done that month?

A. A considerable portion of it had been done in that month.

Q. It had been done before, hadn't it?

A. Part of it.

Q. Did you take any pains to ascertain or know how much of it had been done before?

A. No, that question was not asked, I think, and I never took pains to ascertain.

Q. You knew it was a large sum, didn't you?

A. I did not conceive it to have been earned before.

Q. No, but the work had been done before?

A. Part of it had.

Q. And you were satisfied that the ultimate amount that would become due to him was very considerably in excess of \$350,000, weren't you?

A. Yes, sir.

Q. On that account, you made him a certain allowance, as I understand you?

A. A certain allowance, gauged upon the supposed value of the work done.

Q. But done in part before that month in which the allowance was made?

A. In part.

Q. You have spoken of various opinions which you have entertained in times past, which you also entertain at present, in relation to matters connected with this work. I want to ask you a little more fully than you have stated before, what communications, if any,

you made yourself to the Messrs. Shanly, and what you considered to be your relations to them?

A. I did not consider that I had anything to do with the Messrs. Shanly, except when requested to make certain communications to them by the governor and council, or to get information from them occasionally, when I was there on the ground, as to the progress of the work.

Q. Did you take any pains during your connection with the work to exchange opinions with them in regard to matters connected with the work?

A. No, I did not consider it part of my business, except when I was delegated some few times, for special duty, as to certain questions which I disposed of at the time.

Q. Except as stated by you, did you consider it your duty to have any personal communication with them?

A. Not at all.

Q. That duty belonged to whom?

A. Mr. Frost.

Q. In what instance did you, on special occasions, make any communication whatever to them, orally or in writing?

A. I was requested several times by the governor, or some of the Tunnel committee, to see Mr. Shanly and ask him special questions as to what he would do certain things for: what rates he would charge for certain work outside the contract.

Q. Is that all?

A. And near the close of the work, I was asked to see what arrangement could be made with him for money equivalents in lieu of laying the track and doing some other work connected therewith, at the close of the work; that is all I recollect.

Q. Generally, and indeed almost universally, it may be said, that whatever communications you had were with the governor and council and with Mr. Frost?

A. That is the fact.

Q. I think, in one particular, in connection with the water, you inadvertently fell into an error as to a date. You spoke of striking water in June, 1871. I think it was in March, 1871, was it not?

A. The first serious trouble with water was in March, 1871.

Q. You spoke of advising the adoption of pneumatic drills at the east end at a certain time; were they adopted?

A. I think they were, as soon as they had room. Mr. Shanly made no objections to that course that I ever heard of.

Q. I should like to ask you, generally, Mr. Philbrick, if you agree with Mr. Frost in the statement that in all directions, except in



going west from the central shaft, the Messrs. Shanly proceeded with great vigor in their work?

A. After I became conversant with the work, they did, except as to trimming; I can't say that they did that with great vigor in the beginning; that was a detail, however.

Q. It was all done in time for the ultimate purpose, was it not?

A. No, not done within the time they agreed.

Q. The time they agreed in the contract?

A. Yes.

Q. It was done in such season that there has been no delay in the actual use of the Tunnel by the Commonwealth, for any useful purpose?

A. It was not delayed by their want of trimming; it was delayed by their unfinished work, and the trimming was also unfinished. They were at work on the trimming last summer.

Q. As to that, it may be said, may it not, with safety, that their entire work in the Tunnel has been completed quite as soon as the Commonwealth has been ready to use the Tunnel?

A. They do not appear to be ready to use it yet; I don't know when they will be.

Q. If the Tunnel were finished, sand-papered, and arched from beginning to end, would it be safe to run trains from Troy to Shelburne Falls?

A. I have not been there for six months, so I can't tell.

Q. Do you think it would be safe to put heavy freight trains on that line, such as run over other through lines?

A. From all that I have learned, the work of putting that road in condition is now in progress; I don't know what stage of progress.

Q. So that whatever stage of completion the Tunnel might be in to-day, would not enable the full use of the line as a line for business?

A. I think there are obstacles outside of that, if that is what you mean.

Q. That is, the incompleteness of the railroad tracks outside of the Tunnel, for instance?

A. Yes, sir; I say I have not been there for six months, but I suppose there are such obstacles.

Q. In regard to the matter of going westward from the central shaft, there seems to have been a decided difference of opinion between yourself and Mr. Shanly?

A. There was a difference of opinion as to the propriety of putting in pumps; I think that was the key of the difference.

Before meeting with water, he was as anxious to go west as I was to have him.

Q. But after meeting the water, your opinion as to what was the true policy in view of that obstacle differed from his?

A. It did.

Q. And that is the substantial difference that has existed between you, isn't it?

A. Yes, the only difference of any moment, I think. There were some matters about trimming which have all passed over, which he yielded.

Q. In regard to the trimming, it was done to the fullest extent that you asked, was it not?

A. I believe it has been ; that is, to form and size.

Q. I don't refer to taking down the loose rock outside the lines prescribed.

A. I understand the trimming to form and size to be finished and satisfactory to me.

Q. Then we may consider, at present, that the substantial difference between you and Mr. Shanly in regard to the execution of the work under his contract is limited to the progress westward from the central shaft, may we not?

A. The difference which he has not yielded. There were other differences which arose as I stated, which he yielded.

Q. That is the only difference now existing, which there is any question about?

A. Yes.

Q. In looking at it from the point of view which existed on the 13th of June, 1872, I see that you expressed in your letter which was read this morning the opinion that an advance of fourteen feet west, the last fourteen feet west, brought a new flow of 100 gallons of water per minute?

A. Yes.

Q. And you observed in that letter, that it was useless to think of resuming work at that heading without an additional pump of at least as great capacity as the largest pump then existing?

A. I said so.

Q. You were apprehensive at that time that in proceeding west a large additional flow of water would be encountered?

A. I supposed it might.

Q. Did you think it probable that so much water might be encountered that a new pump of the same capacity as the large one would need to be supplied to deal with it?

A. Well, I thought it possible ; I could not judge of the probabilities.

Q. Was there any way of telling, at that time, how much water might be encountered within the next 100 feet west?

A. No way except to judge of the general character of the other work, at the other end of the workings, in the same class of rock.

Q. It was very wet indeed at the other end, wasn't it?

A. It was no wetter than the same length has proved from the central workings.

Q. I understood you that about 950 gallons a minute were run out at the west end from the portion of the Tunnel which was west of where the connection was finally made of the headings?

A. Yes. That was four times the length of the central-shaft headings, however; three times the amount of water, and four times the length.

Q. But when you had, in going fourteen feet of lineal distance west, encountered a new flow of water of 100 gallons a minute, wasn't there great reason to fear that in going further west, an increased flow of water might be encountered?

A. There was, of course, a chance of it.

Q. Wasn't there a probability of it?

A. A probability, perhaps, that it might be encountered, but I felt there was no reason why any such flow should ever overpower the pumps, because I felt that there should always be a margin of power for raising the water on hand, and that previous to exhausting that margin other facilities should be provided. That flow of water, the additional 100 gallons, as I understood it, did not come in at one hole; it came in from the continuous workings in the fourteen feet of new advance; I supposed it was about a week's advance. If after one blast a sufficient amount of water was encountered to come near the capacity of the pumps, it would not be prudent to go further, of course, but I never knew of an instance where 100 gallons a minute of new water came in after one blast, or anything like that.

Q. But you knew of this instance where one hundred gallons a minute were brought in, in an advance of fourteen feet?

A. Yes; but I understood that to be in a week's work.

Q. Then, you state in your letter, substantially, "if the rock continue to discharge such quantities during the next advance as during the recent advance, even a new pump of the same capacity as his large one would not enable an advance to be made of more than a few weeks"?

A. That is my language.

Q. And that was your opinion at the time, of course?

A. Of course.

Q. Didn't you apprehend that there might be such quantities of new water during the next advance as during the recent advance?

A. There was a possibility of it.

Q. Weren't you afraid of it?

A. Well, I don't know exactly what you mean by "afraid."

Q. Apprehensive?

A. There was a chance of it. Of course, everything inside of that mountain was a lottery; we regarded it as such.

Q. You go on to state in your letter, do you not, that the condition of the rock there could not be ascertained before piercing?

A. Could not be *definitely* ascertained.

Q. Do you say "definitely"?

A. I say so now; that is what I meant; but the general condition of the rock could be ascertained.

Q. What do you say there?

A. Taking it with the context, I think that would be understood.

Q. [Reading.] "Of course, the condition of the rock could not be ascertained before piercing it, and after piercing it, it will be next to impossible to check the flow from newly-cut seams."

A. I wished to state the fact fairly, giving all sides of it.

Q. I think you did state it fairly. Now, under that condition of things, you did consider at that time, did you not, as stated in a subsequent portion of the letter, that if a new pump of the same size should be put in, and if it should be overtaxed with new water, the mining would have to be stopped again?

A. Mining in that direction, yes.

Q. It must be considered, then, that at that time (for I am going back to look at the matter as it looked at that time), there was the greatest reason to apprehend that no pump that could be put in would take care of the water that would be found in going west, must it not?

A. I felt no fear of piercing that water so rapidly as to overpower the pumps, as I said before, and fill the shaft. I felt that the amount of power necessary to keep that work in progress westward was an uncertainty.

Q. You did have great apprehension that even if a new pump should be put in, as large as the existing pump, it would not enable the work to proceed west, did you not?

A. I considered that it was an uncertainty.

Q. I observe, that at that time, you expressed the opinion that the prospect of draining the shaft was good for about February, but not sooner. You thought at that time, of course, that the junction eastward could not be made sooner than February?



A. I thought there was not a good prospect of reaching it sooner ; but, as I said before, in point of fact, it was reached December 12.

Q. They did accelerate their progress?

A. They did afterwards more than before I wrote that letter.

Q. There is proof positive, that between June 13 and December 12, 1872, in working eastward, they accomplished more than you thought there was any prospect of their doing?

A. Than there was a *good* prospect of their doing.

Q. They made, during that time, progress that might be fairly called "extraordinary," might it not?

A. As compared with what it was before.

Q. In view of the difficulties that were encountered in working there?

A. Well, they encountered no serious difficulty in working that eastern heading. There was no water.

Q. There was so much water that the men had to use a boat to get to their work, didn't they?

A. That water was not in the heading, but in the bottom. It took them no longer to go in a boat the length of this room than to walk it.

Q. You would a little prefer, if you were at work there, to have the water out, wouldn't you?

A. It interrupted the hoisting of the rock, but not the progress of the heading.

Q. Wouldn't it make any more trouble, if there was any accident or breakages?

A. There were several breakages, but they didn't interrupt the work on that heading.

Q. Were they not particularly apprehensive of getting flooded out in case of an accident to the pumps?

A. There was apprehension, but nothing happened there ; there was apprehension of the pumps breaking.

Q. Were you not apprehensive that they would get flooded in that heading, going east?

A. They got within a foot of it at one time. I think there was reasonable apprehension then, but that didn't stop the heading. There was, during that summer, at some time,—I can't recollect dates,—some temporary suspension of the pumps.

Q. It came within a foot of coming over the west edge of the bench?

A. It was not a bench then ; it was a heading. If it had come up that foot it would not have endangered the men ; they could have got out easily enough ; but it would have stopped the work.

Q. Supposing they had been working the grade down east, what would have happened then?

A. They would have got up to their knees in water.

Q. If the water had risen above the level of the west end of the heading, it would have gone right on and drowned out their work, wouldn't it?

A. It would have stopped their work, undoubtedly; there was that danger, but it did not interrupt the work.

Q. Do you think a hand-pump would have pumped it out, if it had got over that level?

A. There would have been no place to pump it to. A hand-pump would have been of no use for the water that came from the western heading; that was not what I was talking about.

Q. Don't you know that it came nearer than within a foot?

A. No, I never heard of it.

Q. You know that it got up close at one time?

A. A foot is pretty near; I don't know that it ever got any nearer than that.

Q. As to that book of Mr. Wederkinch's that you spoke of—you have got some minutes of his records of the flow of water?

A. Yes, sir; they were read here this morning.

Q. I understood that you had some minutes that were additional to what were put in in the statement of Mr. Shanly at a former stage of this hearing?

A. I was not here, and don't know what were put in. I heard Mr. Shanly state here once—not from any minutes, but I heard him state verbally—that the flow from the headings west of the central shaft reached very largely in excess of 320 gallons a minute before meeting the western headings; and according to Mr. Wederkinch, that was not the fact.

Q. Mr. Wederkinch's highest estimate was 320 gallons a minute at the time you named?

A. Yes, sir; he told me that was the highest flow that ever occurred.

Q. How often does the memorandum show that measurements were taken?

A. I have not got his detailed memoranda, except the one that is published.

Q. Does that show all the dates?

A. No, I think not; it shows all that he considered were reliable as representing the regular flow. He tested it a great many times, when he thought the observations not worthy of permanent record, because they were subject to intermittent causes which disturbed the regular flow.

Q. Have you got any more measurements of his, except what were published and what were read this morning?

A. I had a good many others in a memorandum-book which I lost at the Tunnel last summer. Those were published in the reports which were produced in evidence within a day or two; one of the Tunnel committee's reports.

Q. Did he make it a matter of any special duty to take these measurements at any regular times after the headings were joined?

A. I don't know that he did after the western headings were joined; he did after the eastern headings were joined; there was a whole year.

Q. How often?

A. I haven't got his record, as I say, and I can't tell how often.

Q. The dates that he gave us were a good ways apart, and not many of them.

A. He told me he took a great many intermediate observations between those, but they were subject to disturbing influences, which prevented their being reported as the regular flow.

Q. There are one or two dates that I want to get, and I should like to know if there is any way in which I can get them.

A. I think it possible he might give them to you.

Q. He is in Nevada, isn't he?

A. Yes, sir.

Q. Do you know how much water flowed out of the west end after the two headings were joined, November 27, 1873?

A. Well, it did not begin to flow west from that junction immediately—not until some time afterwards. The levels in piercing the heading were kept on an inclination towards the central shaft, and it did not begin to run west until a good many months after the junction.

Q. Do you know what has been the greatest measure of water at the west end, since the water from the central shaft went that way?

A. No, I have not heard.

Q. Wasn't it stated by somebody that there was a flow considerably larger than 930 gallons a minute?

A. It must be now; it has nearly the whole 320 gallons, in addition to the 930. Nearly the whole of that 320 came from the work west of the central shaft; there was very little water pierced east of the shaft.

Q. You were up there at the commencement of your service, as I understand you, sometimes once a week, and you stayed sometimes a week?

A. I stayed sometimes a week; I went there sometimes three or four weeks in succession.

Q. But that was limited to the early part of your service?

A. Yes, the first two years.

Q. After that, how often did you go?

A. After that, I averaged about once a month; sometimes oftener. I went there regularly once a month, with some few exceptions.

Q. In 1872, how often did you go up until the time of the junction of the headings in December, 1872?

A. I was there oftener than once a month, generally.

Q. And how long did you stay?

A. Until I got through my work; it was sometimes a day or two, and sometimes several days.

Q. Did you take any special pains to see Mr. Shanly on those occasions when you went up, usually?

A. No, not unless I had special business with him, and it was very rarely that I had.

Q. Did you usually, when you went up, go into the Tunnel, at all portions of the work?

A. Not at all portions every time, but I generally went into some portion every time. I generally went there for some special duty, in some portion.

Q. Did you usually go into the work at times when the men were at work, or when they were not?

A. I went in oftener when they were not.

Q. That would be Sundays?

A. Sundays and other holidays; but I remained until they drove me out by blasting. I have often been there 18 hours in succession.

Q. Inside the work?

A. Yes.

Q. Taking lines, and things of that sort?

A. Testing lines, and getting other information. I will state, that the only responsibility I had in connection with the prosecution of the work, was to satisfy myself, in accordance with my instructions, of the accuracy of the working lines by any means I chose, and I did not choose to delegate the responsibility to anybody else.

Q. You spoke about the roof east of the central shaft where he worked above the line?

A. Yes, sir; that is in the mica-slate portion of the Tunnel which lies nearly horizontally stratified; it is a very flat roof.

Q. That was the work that was prosecuted in the summer of 1872, was it not?

A. It shows exactly here [on diagram], beginning in January, 1872, and running to October, '72, above the lines.

Q. You are, of course, familiar with this report of the corporators appointed under the Act of 1872, chapter 403?



A. I have read it; I can't say I am very familiar with it. I have never read it but once, except certain portions of it.

Q. I see on page 57 of the appendix there is a table showing the number of lineal feet of Tunnel, that three or more experts agree must be lined with brick, in which there appear to be 3,039 lineal feet east of the central shaft at different sections, most of them being from station 9,000 to station 11,850.

A. That leaves off within 250 feet of the end of this high roof, for the high roof terminates at station 11,600.

Q. And the high roof begins, where—at the west end of it?

A. It begins at 12,500.

Q. Are these the same stations that were used there?

A. I suppose so; I have no means of knowing. There were no other stations, however, ever heard of, I think.

Q. And west of the central shaft, I see that by their statement there are 5,534 feet given?

A. Yes, sir.

Q. Making 8,573 feet. Now, Mr. Frost stated, taking those same identical lineal feet, as I understood him, that in that portion east of the central shaft the excavation outside of the prescribed lines of the Tunnel would amount to 8,633 cubic yards.

A. I understood him a higher figure than that.

Q. And in that portion of the Tunnel west of the central shaft, 5,534 feet, the excavation outside of the prescribed limits would amount to 14,005 cubic yards, making for the 8,573 feet a total of 22,638 cubic yards.

A. Well, I think you must have got east and west transposed, because there was very much more taken outside the lines east of the shaft than there was west; that is my recollection of it, and the profile shows it.

Q. Do you think that the amount would come to more?

A. If you are summing up the whole length of the western workings, you can make a rough estimate in a moment here.

Q. I understood Mr. Frost to take the identical 8,573 lineal feet that the three experts agree upon as requiring arching.

A. That does not cover any large portion of this high roof east of the shaft. It does not include that mass; it only includes 250 feet of it.

Q. Now, have you examined these estimates of his to see whether you agree with him or not as to the amount of excavation beyond the lines in the portion of the Tunnel that the experts thought would require to be arched?

A. I have not.

Q. That is new to you?

A. That is new entirely.

Q. Did you differ in opinion from these experts as to the amount that would require arching?

A. I felt more confidence in the roof than they felt. I think it is very natural that I should, for I had been a great many more hours under it.

Q. You stated in your direct examination here, that east of the central shaft the roof was firm?

A. Generally.

Q. And, if I understand you, your opinion is, that it is firm enough to do without arching in many places where the experts who were called in by the corporators think that arching will be required?

A. That is my opinion.

Q. How much was the total that you thought would require arching in the whole length of the Tunnel, that is now not arched?

A. My report was made and published in that same document. My examination was made last July according to the light then shown; subsequent to which a great deal of roof has been stripped which was not then visible. I reported some 3,500 feet that I regarded as doubtful, and I think some 1,500 feet as certainly needing arching. My figures are rather uncertain in my mind; they are in print there, at any rate.

Q. Your estimate was considerably below the lowest of those experts, wasn't it?

A. My estimate was taken several months previous, and a great deal of roof had not been exposed at the time when I took that observation which was exposed subsequently when they went in. They went in in September; my examination was in July. My estimate was a good deal below theirs.

Q. Have you been over it again so as to revise the opinion you expressed in that report?

A. I have not.

Q. So that whether you would agree with them now or not you cannot tell?

A. I am pretty sure that I should have more confidence in several spots than they did, because I am more familiar with them.

Q. There were three of them, and they united on 8,513 identical feet?

A. I believe so; yes.

Q. And your opinion was that about 3,500 feet, as you expressed it, was all the arching that would probably be required?

A. In addition to a certain amount which I considered certain,

Q. 1,500 feet was certain and 3,500 feet possible, in addition?

A. Yes, sir; but a great deal of that roof has been stripped since, which I did not report upon.

Q. They had a better chance to examine it than you had, hadn't they?

A. They had a better chance, except that they had much less time. They spent only a few days' time, and I had spent weeks and weeks, and had become more familiar with the character of the work I reported upon; but certain points they were able to report upon which were not visible when I made my examination.

Q. I see that you differ from them in the name that is to be given to describe the rock west of the central shaft?

A. Well, I give the general name, and they give specific names, which I did not go into.

Q. I do not find any one of them that calls it "mica-schist" west of the central shaft, for some portion?

A. I did. They call it "mica-schist" for the whole mountain. There are a number of sub-divisions, sub-classes of that rock. They give numerous classes of mica-schist; there are a great many names which they went into, and I did not.

Q. I see in one place they call it "granitoid gneiss"?

A. I have always thought that rock would be classed as mica-schist; but of course I am less familiar with geology than they, and they went into more detail than I did.

Q. What does "granitoid" mean?

A. Having resemblance to granite, I believe, in its crystalline character. I suppose that you are as familiar with the etymology of the word as I am; "oid," I believe, generally denotes resemblance.

Q. I see that it is spoken of as a "granitoid rock," in one instance, by Dr. Sterry Hunt?

A. That means "having a resemblance to granite," as I understand it, and it certainly does.

Q. Is it composed of the same elements that granite is composed of?

A. The same ingredients, but in different relative quantities and in a different degree of crystallization; and I think granite has some ingredients which this has not.

Q. What?

A. I think there is some little hornblende in that.

Q. I see that Dr. Hunt here speaks of "granite-like rocks"?

A. Yes, sir; that is what I understand by "granitoid."

Q. That is a matter of nomenclature, I suppose, merely?

A. Yes, sir; the physical character of that rock certainly differs east and west of the central shaft in this respect, that it was subject

to manifold seams, inducing water, west of the shaft, while east of the shaft it was comparatively free from such.

Q. Did not the character of the rock differ also in other respects besides seaminess?

A. It was more crystalline west of the shaft.

Q. More like granite, was it not?

A. Yes, sir; had a resemblance to granite, which east of the shaft it had not.

Q. You spoke of an interview with the governor and council in anticipation of the settlement of December, 1874; I suppose you expressed opinions on all these various matters there?

A. Whenever I was asked, and sometimes when I was not asked.

Q. In reference to that water-course that broke away and caused the damage in the fall of 1869, did you understand that that was an artificial water-course, maintained by the State, where the bank broke away?

A. It had previous to the contract been maintained by the State, I understood.

Q. Did you know that?

A. No, I never saw the work until after that date.

Q. In December, 1874, when you had your interview with the governor and council, did you know anything about that?

A. I knew nothing except what I had gathered during my connection with the work. I was not on the ground there for some time subsequently to that storm. My first connection with the work was in the autumn of 1870, nearly a year after that storm. I never had been there except as a traveller to walk over the mountain a year before, from curiosity to see the work. I have no recollection of a canal there.

Q. Did you understand that the breakage was in the bank of the canal, or did you suppose it was in the bank of the stream, where it was a natural stream?

A. Well, I had never formed an idea about it; did not know anything about it.

Q. You did not look into that subject at all?

A. No; I can readily see how such a result would follow from such a flood, whether the bank was natural or artificial, because the inclination of the stream changed at that point. The stream is very steep and rapid in its fall above that point, and below that point it is less so. A flood always brings down a lot of debris, and it would naturally fill the channel brimful of rubbish at the time and overflow the banks. It is at the foot of the fall. I think it more than probable that the whole channel was filled up with rubbish, stones, and sand.

[Adjourned to Friday at 10 A. M.]



FRIDAY, March 19, 1875.

MR. EDWARD S. PHILBRICK made an explanation of his testimony, as follows :—

Mr. Allen asked me in relation to the reasons for not running down grade east of the central shaft, in running the heading east, where the grade descended and the work did not, for several months. He asked if the pumps had failed to get out the water, and it had risen up to the level of the heading, if they would not have been driven out by the water, and I replied that they would; but it occurred to me afterwards, that he might have taken that in connection with their running down grade, and I did not see why they would not have been stopped just as decidedly whether they ran down grade or not; I think it was immaterial as to their being stopped.

TESTIMONY OF HON. HENRY G. CROWELL.

Q. (By Mr. TRAIN.) Mr. Crowell, you were a member of the executive council, at what time?

A. In 1870 and 1871.

Q. Were you on the Tunnel committee?

A. Yes, sir, I was.

Q. Both years?

A. No, sir; I was the first year.

Q. In 1871?

A. I was.

Q. And what position did you hold upon the committee in 1871?

A. Well, I was simply one of the committee; the lieutenant-governor was chairman of the committee.

Q. That was Lieutenant-Governor Tucker?

A. Lieutenant-Governor Tucker. I had perhaps as much to do with the Tunnel as any one of the other members of the committee.

Q. Did you make up the accounts?

A. I examined the accounts when they were sent in.

Q. And how often did you see the Tunnel itself during that year?

A. Only three or four times, I think.

Q. Did you know of the letters addressed by Mr. Philbrick to the governor as well as those that you received from him?

A. I cannot say that I am familiar now with all the letters; I remember receiving frequent letters from Mr. Philbrick and showing the letters that he communicated to the governor.

Q. I suppose all official communications between the engineer and the governor were laid before your committee?

A. Yes, sir.

Q. Have you examined the letters which were referred to by Mr. Philbrick yesterday?

A. Yes, sir, I have.

Q. I want to know whether or not you communicated substantially to Mr. Shanly or his brother the contents of those letters?

A. I don't think I sent him any written communication at all.

Q. I don't care whether they were written or oral communications.

A. Our conferences with Mr. Shanly were when he came down here, chiefly at the council chamber. I don't remember any written communication to him.

Q. Well, in these conversations, was he made acquainted with the reports of Mr. Philbrick and of Mr. Frost?

A. Yes, sir.

Q. Was the information in the letter to yourself of February 17 conveyed by you to Mr. Shanly and made a subject of conversation?

A. I cannot say that I communicated it, but the substance of that communication was communicated to Mr. Shanly by some member of the committee, I understood by the lieutenant-governor.

Q. What I want to arrive at is this: whether you insisted to the contractors that they should perform their contract according to its terms, and follow the advice and directions which you received from the engineers?

A. If you will allow me to state it in a general way, as a member of the committee, I felt that we should be governed by the communications which were made to us by the engineers. We were not any of us engineers, or competent to judge about what was necessary to be done, and we insisted upon Mr. Shanly's following the directions of the engineers.

Q. Do you remember whether the matter of pumps at the central shaft, and of working according to the contract east and west from the central shaft, was a subject of conversation between you or the committee and the Shanlys?

A. In the latter part of 1871,—I think it was the autumn of '71, when Mr. Shanly was working westward from the shaft,—he announced that there was a great deal of water coming upon him, and we had communication with him at that time, and I think we concluded that it was not perhaps wise for us to insist upon his pushing the work west from the central shaft. I think the engineers did not press that upon the council.

Q. Well, do you mean to say that he was told he need not do it, or that it was allowed to subside?

A. It was allowed to subside; we did not tell him that he need

not do it. My impression is now that Mr. Philbrick said something to me to the effect that with more pumps there the water might be removed and they could proceed with the work, but it was questionable, I think, with the council at that time whether he would not find more water, and more than he would be able to remove with another set of pumps, even.

Q. This was in 1871?

A. That was in 1871.

Q. You were not in the council in 1872?

A. No, sir.

TESTIMONY OF HON. CHARLES ENDICOTT.

Q. (By Mr. TRAIN.) Were you ever a member of the executive council?

A. Yes, sir; in 1868 and '69.

Q. Were you on the Tunnel committee in 1868?

A. I was not on the Tunnel committee in 1868, I think; in 1869 I was, and I was to some considerable extent, perhaps, in consultation and action with the Tunnel committee. I think I was regularly appointed upon the committee that year.

Q. Did you know at the time the proposals were issued for the contract for the completion of the Tunnel?

A. I did.

Q. When did you first see either of the Shanlys in relation to that subject?

A. Well, I can hardly say when I first met Mr. Shanly.

Q. When were these proposals sent in for the purpose of making the contract?

A. I think in July, or August, possibly.

Q. That was for an item contract, as I understand it?

A. The specifications were put out for bids by items.

Q. Now will you go on and give a history of this thing, as you recollect it, down to the time of the execution of the contract?

A. Well, that would be a long story, Mr. Train.

Q. You may make it as short as you have a mind to; I want to get at the *modus operandi* by which the thing was finally arrived at.

A. The Act of 1868 was passed authorizing the governor and council to make a contract for the completion of the Tunnel, provided they could do it, with satisfactory guarantees, within a limited space of time,—I think seven years,—and a limited amount of money, five millions of dollars. Under that specification, the notice for proposals was issued, and published largely in the papers, I think, both of this country and in Europe, or England, and pursuant to that notice, I don't remember the exact number, but perhaps a

dozen bids were received, some for a portion of the work, and some for the whole. These bids having been opened, were referred to the engineers and commissioners to state the results, and they made a report, whereupon it appeared that the firm of Carpenter, Odiorne & Gardner were the lowest bidders; and thereupon negotiations were commenced with that firm for the contract. The requirement was, in the way of security, with reference to the bids under that issue of notice for proposals, that the contractors should put up half a million of dollars in good securities,—I think in registered United States bonds, or, possibly, Northern State bonds,—I don't remember distinctly about that, but they were to be good bonds, that were satisfactory to the governor and council. I don't think there was a stipulation that they should be United States bonds; it is possible it might have been so; my impression is it was not so, because I know we had an offer of various Southern bonds from other parties. Carpenter, Odiorne & Gardner gave notice to the governor and council that they would be prepared to put up the amount and execute the contract. Considerable delay was had with them, and they finally gave up and withdrew their claim, or their claim was rejected, upon their failing to comply with the terms. Thereupon the next bidders in amount, who were, I think, Uran Brothers, were notified, and we had a long preliminary negotiation with them, and they finally withdrew. The third bidders in amount were the Messrs. Shanly, and they were notified, after the two preceding parties had been disposed of, and they went into the work of raising or seeking to raise their security, but finally, at some time, they gave notice that they had been unsuccessful in making their arrangements, and, as I remember, they withdrew. Then we went through, as I remember it, the entire list of bidders who were within the five million dollars, and they all failed to put up the requisite amount of money or bonds. Then the governor and council opened the matter with some other parties who sought a negotiation,—Dillon, Courtwright and others,—and considerable conversation was had with those parties, they objecting to doing certain things. I think they desired to abandon the central shaft altogether. At one time that matter was seriously talked of. They did not make, I think, so large a deduction for the abandonment of the central shaft as was satisfactory to Governor Bullock, and thereupon proceedings were had to invite the Messrs. Shanly into the matter again, and they came on and proceedings were immediately had and were followed up until the result was the contract which was finally signed.

Q. Was there any change adopted when the Messrs. Shanly began to negotiate the second time, as to the character of the con-



tract? Was it to be an entire contract for the completion of the Tunnel, or a contract for specific work?

A. Well, the first draft of the contract that was presented to the council, I think, was drawn by the engineers, possibly by Mr. Latrobe, and presented to the council by them, or by the commissioners, which provided for a contract in piecemeal, possibly per cubic yard; the amount depending upon the aggregate amount of work and excavation to be done, to be determined only upon the final settlement under the contract. That form of contract was rejected by the council as not being within the terms of the law. It was the idea of the governor and council, as I understood, that the contract on its face must appear to be a contract within the terms of the law; that is, within five millions of dollars, and within the period of time prescribed, seven years. It was decided that the amount should be a gross amount, not to be affected by errors in estimates of quantities, should they be larger or smaller; a less number of yards of excavation was not to affect the gross amount; a larger number was not to affect it. It was intended to make the contract a complete contract, for the entire work, without being subject to variation by reason of there being more or less work to do than the estimates contained in the contract.

Q. Did Mr. Shanly or his brother, or both of them, understand that?

A. I have no doubt Mr. Shanly would say that they did.

Q. How much time was occupied in finally reducing the contract to execution?

A. After Mr. Shanly came on here, I should say two or three weeks, but I am not certain about the time.

Q. Was he in attendance with his counsel?

A. He was there; yes, sir.

Q. Who was his counsel at that time?

A. Mr. E. Hasket Derby appeared for Mr. Shanly as counsel, and the attorney-general was present occasionally.

Q. Mr. Allen was then attorney-general, I think.

A. Yes, sir.

Q. The contract was finally signed on the day of its date, I suppose?

A. Yes, sir, I think so. I guess the date of the contract was the last thing put into the printed blank. I should say so from my recollection, although I haven't seen the original for a long time. Of course, when I say the entire completion of the Tunnel, I except the work that was then under contract to Mr. Farren—certain arching.

Q. You were in the council in 1869?

A. Yes, sir.

Q. How soon did Mr. Shanly get to work, do you remember?

A. I think early in the spring of 1869.

Q. You knew Mr. James Laurie?

A. I knew him somewhat. I met him several times at the Tunnel. Mr. Latrobe was consulting engineer when the contract was made, and subsequently I think Mr. Laurie was appointed, and I met Mr. Laurie perhaps three times at the council chamber, and sometimes, I remember, at North Adams, at the Tunnel.

Q. When was he finally dismissed, if you remember?

A. About the beginning of the year 1871, I think. That was after I left the council; but, of course, I had occasion to know, as auditor, as he drew for his pay.

Q. You were on the committee in 1869, I think you said?

A. Yes, sir.

Q. Was this matter of the damage occasioned by the great storm of October, 1869, referred to your committee?

A. It was.

Mr. TRAIN. I have put into the case certain propositions which seem to have been arrived at by your committee. I want to have you explain the principles on which you arrived at those results, if there was anything more than appears in the propositions themselves. Will you state what action your committee took in arriving at those conclusions?

A. I think they are fully stated in the propositions adopted.

Q. And they were intended to cover the whole ground?

A. The grounds there stated were the grounds on which the council proceeded. I may say here that those were matters which Mr. Shanly never assented to.

#### CROSS-EXAMINATION.

Q. (By Mr. ALLEN.) In reference to that matter of the storm damages, the claim that was before the council related only to the west end, did it?

A. I think so.

Q. Did you pay particular attention to that matter when it was before the council?

A. My impression is that I did not, when the bill was sent in; I think Lieutenant-Governor Tucker prepared that report which was made upon the bill.

Q. I see that in this report of the committee of the council, which is signed by Lieutenant-Governor Tucker, and in the propositions that were drawn up and also signed by him, the water-course is constantly spoken of as a brook?

A. Yes, sir.

Q. Is it within your recollection whether you understood at that time that this was a canal which had been built by the State, that broke away?

A. I only remember that it was spoken of as a brook, and it was treated as a mountain brook. I think that we did know that that was not the original bed of the brook. I don't think that matter was ever regarded by the committee as being important, whether it was so or whether it was otherwise.

Q. It occurred to me as possible that you might have been under the impression that that was a natural stream, and did not pay attention to the fact that it was an artificial canal, built by the State and maintained by the State, which broke away?

A. I think that we knew that this was not the original bed of the stream, because there were indications of the old bed on the other side, where the water did not enter it, and we had some trouble with an owner of real estate, who said he was cut off, and made some claim against the State by reason of his water having been taken away from his farm-yard.

Q. Did you go up there to see this place yourself?

A. Yes, sir.

Q. At what time?

A. In October, immediately after the storm. The date of the propositions was the 13th of October, and the storm was on the 4th and 5th, as I remember. You will find the orders of the council of the 15th of October based upon the principles of that report. There were two orders, in which it was agreed to pay the entire charge of equalizing the burden upon the Farren arch, and half of the cost of repairing the breach in the brook, to keep the water off of the arch.

Q. Do you mean anything different from what these propositions show?

A. No, sir; they were put in here, as I remember, when I was here at a former hearing, by Mr. Train.

Q. At the time that the contract was made with the Messrs. Shanly, did you understand that they undertook to do any more than what the contract expressed on its face?

A. I don't think I did. I will answer the question directly if I understand precisely what is involved in it. I understand that where estimated quantities were given in the contract, or distances, they were to be controlled by the general language of the contract.

Q. I am not asking, at present, what your construction of the contract is; my question is whether you understood that they intended to bind themselves to anything more than the contract, according to its just construction, expressed on its face?

A. I think I should say no to that.

Q. Here is one of the monthly returns of work, selected without reference to any particular thing which it contains. I would like to ask you if that is the general form in which the returns were sent in to you every month?

A. I have no doubt it is, though I never had to do with those matters myself, personally.

Q. Did you examine them during the time you were in the council?

A. I may have done so slightly, with Mr. Adams. I think that this matter was examined more particularly by Mr. Treasurer Adams, who was then in the council, and had charge of that particular class of work.

Mr. ALLEN. I would like to ask Mr. Frost a question as to those returns.

Q. (To Mr. FROST.) Is this the form of returns that were sent in every month?

A. Yes, sir; that is to say, it was one of the returns that was sent in. This was not the estimate, nor required under the contract.

Q. Is that the paper which you and Mr. Laurie got up?

A. That's it.

Q. And that [another paper] is the estimate?

A. That is the form of the estimate; yes, sir.

Q. Each of those was sent in every month?

A. Yes, sir. In regard to this printed document, I think it should be stated that some member of the council was at North Adams, and examined it up there. It was not conceived to have any permanent effect; it was simply a verification of the details of the estimates by which the particular members of the council having charge of it could verify by a certain comparison of details, so as to see if there was absolute correctness in my statement of total quantities.

Q. Did you send a statement of this kind with the statement of the general average total?

A. It was prepared, and in some way came to notice. When you speak of sending it, I make that slight limitation.

Q. Sometimes it was delivered at North Adams?

A. Yes, sir.

Q. But it was prepared?

A. It was prepared as a means of verification and testing.

Q. (To Mr. ENDICOTT.) I see in that first claim that there is a statement of prices of the total assumed quantities, which at the



bottom foots up the exact amount at which the contract was made ; do you observe that ?

A. Yes, sir ; I do.

Q. Did you understand that the contract price was arrived at by the summing up of those items ?

A. Not exactly ; I did not. I have an idea that this thing was a thing that was got up subsequently to the making of the contract, and was a thing that I never gave any attention to. I never understood that the measurements came out precisely in any form.

Q. I am talking about the way the contract price was arrived at. Did you not understand that Mr. Shanly and Mr. Frost went over the items together, and that Mr. Shanly arrived at the amount of the contract price by adding up these identical items together, as given there ?

A. I never knew or understood precisely how that was. I have an impression, that in certain of these estimates, certain sums were put down for contingencies,—there are no contingencies here, as I see. I cannot answer with reference to that, because it is a matter I never had any knowledge of. I knew Mr. Shanly was in consultation with Mr. Frost at the time that this contract was made, and that Mr. Frost, as I understood, gave Mr. Shanly all the information that he had in relation to those matters. You will find that there are clauses in the contract showing that the governor and council did not propose to be responsible for the correctness of these estimates.

Q. I wasn't asking about that. Whatever there is there is on the face of the contract, and it can be construed ; but I was having reference to the fact that the summing up of these items amounted to the same identical sum as that named as the price of the work in the contract, and I asked you if you knew anything as to whether Mr. Shanly arrived at that price, when he was making his contract, by the addition of those identical sums ?

A. I suppose that that table was never made until some time after the contract was made ; still, that is a matter I have no knowledge of.

Q. But wasn't this made up from the schedule that was used by Mr. Frost and Mr. Shanly ?

A. It is possible it may have been so. I have no knowledge of that matter.

BENJAMIN D. FROST—*Recalled.*

Q. (By Mr. TRAIN.) Since testifying yesterday, has anything occurred to you which you wish to say in relation to your testimony ?

A. There seemed to be an apprehension on the part of some members of the committee, day before yesterday, that I hesitated in answering the question proposed by the attorney for the Messrs. Shanly. There was no hesitation in my answer, if I could explain the position of the matter. In February, 1872, the matter had been duly considered, and it was believed by the members of the council that the Messrs. Shanly ought to put in pumps, and there was a hearing on an appeal before the council. But the question was waived, in order that the Messrs. Shanly might find a different method of doing the work, which they thought they could, and of still pressing westward. But it was rather the opinion of the executive, that the orders of the council should not be, in detail, as to the manner in which they should proceed with their work,—not prescribing exactly the form, but, in general terms, requiring them to go on, leaving to them the methods in detail of doing it. Therefore, when it was asked of me what I thought of that order of June, 1872, I sought to explain the method in which the order had been framed. I don't know of any other matter, except that the quantity over and above the lines of actual excavation, made at certain points condemned as bad rock by three experts, have been given by me to Mr. Allen.

MR. TRAIN. That does not do me any good. I want to know what it is myself.

WITNESS. Well, sir, the statement has been given, in accordance with the request, and as part of the testimony.

MR. TRAIN. I supposed it would be given to me, and not to the other side.

WITNESS. I will have a copy made of the tabulated statement, year by year, showing the quantities of water which were made in the central shaft at such times as accurate and certain observations could be obtained. The reason why it was difficult, at many times, to get the exact amount, has been stated already,—the irregular working of the pumps.

Q. This paper is headed in this way, "Approximate estimate of quantity of extra excavation made by F. Shanly & Company outside of lines of rock-excavation, over ground condemned by three experts, east of the central shaft." What do you mean by "over ground condemned by three experts"?

A. I speak of the order of the legislature of last year, requiring that the board of corporators should employ experts, who should examine the rock in the Tunnel, and report as to the quantity of arching which, in their opinion, was deemed requisite.

Q. This really means, when it is brought down to common-sense,

the quantity of excavation outside the lines where arching is required to be done?

A. Where three experts say it is required to be done.

Q. I don't care who said it; the fact is, it refers to the places where arching is to be done. What does it show?

A. It shows that, east of the central shaft, there were of that kind of work, 8,633 square yards.

Q. (By Mr. ROBINSON.) Where it is to be arched?

A. Where these three experts condemned the ground. Some of them said further trimming might induce security, but substantially it means the portions where they thought it was bad ground. I have given east of the central shaft; west of the central shaft there are 14,005 yards.

Q. (By Mr. CUMMINGS.) That is to be arched?

A. Over lengths which these three experts say require further excavation for this purpose; they unite in so declaring. There have been this number of yards taken out by the Messrs. Shanly outside of their contract lines. That embraces the foot or more that broke out in their explosions, and also the quantity which they took out by running too high east of the central shaft. It embraces all their departures, outside of the lines I prescribed, within those lengths.

Q. You stated, the other day, that they had not taken out as much rock as the contract covered. Did you include this amount in that?

A. No, sir.

Mr. TRAIN. Mr. Shanly claims that they have removed more rock than the contract covered. Mr. Frost stated that they had not removed so much. Now, he states that the rock moved outside the lines was not included in the estimate of what the Messrs. Shanly had removed,—is that it?

A. That is, I did not include it in making up that statement. I was just referring back to a comparative statement, to show what was the actual fact, to see whether, adding in this 22,000 yards, would carry the balance in the other direction.

Q. (By Mr. ALLEN.) That was 1,879 yards, wasn't it?

A. That is the story.

Q. (By Mr. MOSELEY.) If I understand it, this difference is not at all included in Mr. Shanly's claim. Whatever is taken out above the outside circle, that he takes out on his own account,—is not that so?

Mr. ALLEN. Certainly, there is no claim for that.

Mr. TRAIN. No, but as I understand the suggestion yesterday, if we are considering this as an equitable matter, Mr. Allen says,

in reply to my proposition that they haven't got out so much rock as the estimates call for, "That is true, so far as it goes; but, then, in another place we have got out more, and one offsets the other." That, I suppose, was his idea.

Mr. ALLEN. That is true. I shall say, undoubtedly, that whereas Mr. Frost, in the estimates he has made, finds that the State did not require of Mr. Shanly as much excavation as they might have required into 1,879 yards, yet, on the other hand, according to Mr. Frost's own statement, in portions of the Tunnel that, in the opinion of three experts, require to be arched, the Messrs. Shanly have taken out 22,638 cubic yards of rock which were outside of the lines which were prescribed for them.

Mr. MOSELEY. And that if those portions of the Tunnel are to be arched, that rock would have had to be removed if the Shanlys had not taken it out, and therefore that expense has been saved?

Mr. ALLEN. That will save the State \$250,000 at the prices that are allowed in the contract to Mr. Shanly for doing that kind of work.

Q. (By Mr. TRAIN.) Do you agree with that statement of Mr. Allen?

A. That is substantially the fact.

Q. If arching is obliged to be done over this ground where the experts have made their examination?

A. Yes, if arching should be finally concluded upon through that distance. The only question to be considered in that connection is this: supposing six yards were required outside the contract lines, Mr. Shanly took out two of them, and the contractor who had to take out the other four would not take them out at so low a rate per cubic yard as if he had a breast of six feet to work, because it would become more akin to trimming work. That is, it is taking out a very thin shell, and he would demand to be paid for it at a higher rate; so that that would reduce this apparent difference.

Q. (By Mr. MOSELEY.) What is the thickness of this brick arch?

A. It is variant; I haven't put in any yet less than 20 inches, running up, in one case, to two feet.

Q. (By Mr. CUMMINGS.) It is filled up to the rock, backside, with brick?

A. No, sir; I don't fill up in that way. I prescribe a certain thickness of arch, and the contractor tries to take out the rock so as to just make room to put in the arch. If he takes out the rock wider than is necessary, by want of care in excavation, or by unavoidable circumstances, he is obliged to pack in behind the brick-work so as to make it close up to the rock.



Q. What does he put in for that?

A. The arch would not stand by itself if the force came on one point of the curve only. He backs with stone, under the contract; but in some cases the contractor has chosen to fill in with brick to complete the wall; both stone and brick are used.

Mr. TRAIN. I don't quite understand this business yet. You required the rock to be taken out to certain lines, and they took out the quantity of rock outside of the lines which you have given us. Now, what kind of rock was that? and what did it cost them relatively to get it out, in comparison with the contract prices? There has been a large quantity of that rock taken out,—was it demoralized rock, loose rock, shattered rock?

A. Yes, sir.

Q. That has been examined by experts and portions of it have got to be arched. Mr. Allen claims that if it is to be arched it will be worth \$250,000 to the State,—this work which the Shanlys did outside of their contract. I want to know the character of that work; what it cost them to do it; whether it was solid rock or loose rock; whether they blew it out, or took it down with bars, or what?

A. Part of that is due to their working too high east of the central shaft. That portion cost them as much as if they had kept inside the lines to work. In that portion east of the central shaft, where they got too high in the workings, it cost them just as much as if they had worked in the lines, per cubic yard. It was an irregularity of working outside. In regard to some other portions, they have been the result of falls in part. I made a sort of approximate estimate, which I will hand in presently, showing what usually comes down, as a sort of general average, in working through solid rock, where it has been carefully worked, outside the contract lines,—that is, showing what was virtually excess derived from their working too high, or from their having falls coming down on them that they could not prevent.

Q. (By Mr. MOSELEY.) What do you mean by “working too high”?

A. In going eastward from the central shaft, by reason of not putting in the hand-pump which Mr. Philbrick spoke of, they, for a considerable time, instead of descending the grade from the central shaft eastward, all the time descending, kept about level to get rid of the water, so that they were all the time running up above the lines prescribed.

Q. (By Mr. TRAIN.) Have you got the computation made which I asked you to make, showing how much more the contractors got under this contract than they would if they had taken the contract as an item contract?

A. Yes, sir.

Q. Have you got it here?

A. I will find and submit it within a little while. I left certain papers down town, not thinking they would be wanted, but I will find it within an hour and bring it here. I have made it.

Q. (By Mr. CUMMINGS.) What is your opinion now, looking back: was it an economical and judicious movement, on the part of the State, to sink the central shaft at all? Mr. Endicott tells us that they had contractors who proposed working from headings each way. Has the result proved that sinking the central shaft was an economical and judicious measure, setting aside its uses for purposes of ventilation?

A. As it has turned out, it is a matter of doubtful economy. As originally projected, and serving the purpose that it was intended to serve in expediting the completion of the Tunnel, it was clearly an economical device.

Q. But the results have proved that it would have been better not to have sunk it?

A. In the way it was left. There was one whole year where it was not worked at all, for the reason that there was only a partial appropriation; then there was a year in which there was very little done from it, under the conditions of this contract.

Q. Did it actually expedite the completion of the Tunnel?

A. It did.

Q. How much, do you think?

A. A few months.

Q. Only a few months?

A. Only a few months.

Q. (By Mr. TRAIN.) What was the year you speak of when it stood still for want of an appropriation?

A. From that cause, and for other reasons. The shaft-buildings burned down in 1867, and the appropriation of 1868 was only a very limited one; so limited that it was not thought wise to incur the heavy expense, out of so small an appropriation, necessary to work it. So that during the whole of the year 1868 it may be said to have lain without any progress. From November, 1867, until the middle of 1869, there was no progress made in the sinking of the shaft.

Q. (By Mr. CUMMINGS.) Have you had sufficient experience now to be able to say whether it will be a benefit in the ventilation of the Tunnel?

A. Yes, sir; it will be of very great benefit.

Q. It is to be kept open for that purpose?

A. It is.

Q. (By Mr. HOLDEN.) You spoke of Mr. Williston, one of your assistants?

A. Yes, sir.

Q. Who employed him?

A. I did.

Q. Did you subject him to any examination to know whether he was competent or not?

A. I did.

Q. Was that examination satisfactory?

A. As a general rule, yes, sir. I should not have employed him unless I found him thoroughly competent.

Q. What was the rule in regard to the employment of assistants generally?

A. My work was a daily examination of them.

Q. Before they were employed, did you make any examination of them?

A. I usually employed a man on the information I had and the letters which he brought. But I usually employed them on trial. I told every man that I took that I took him on trial; but if, on trial, he proved to be such a man as I wanted, I usually made his pay more appropriate. I always employed them at small pay at first, as a usual thing, and generally made their pay more appropriate for the work I set them at.

Q. They were not any of them required to go through a particular examination, were they?

A. No, sir.

Q. (By Mr. MOSELEY.) With your experience, if you were going to make another Tunnel just like this, would you sink a central shaft again?

A. I would, and I would drive it right through; what we see now shows exactly how the thing should have been pressed. That is, taking it for granted that the same feelings prevailed that prevailed at that time; that is, that the State demanded the completion of the Hoosac Tunnel at the earliest possible moment.

Q. (By Mr. CUMMINGS.) I want it considered simply as an economic measure; if you were going ahead to-day to do that work in the most economic and judicious manner, would you sink the central shaft?

A. The term "economic" covers just the ground of time,—the time when to arrive at the use of the Tunnel.

Q. You know what the question is?

A. I do, and I will answer it exactly in this way; it was proposed to pay the cost of sinking the central shaft in order to

expedite the completion of the Tunnel, and hasten the time when the Tunnel should be completed.

Q. I want to know whether, if you were going to do the job, you would, with your present knowledge, consider it an economic and judicious measure to go ahead and sink the central shaft in order to make the Tunnel?

A. Yes, sir, I would.

EDWARD S. PHILBRICK—*Recalled.*

Q. (By Mr. TRAIN.) I think there is a little misunderstanding in the minds of the Committee in relation to the policy of the executive department in reference to pushing the work in the west heading. Some gentlemen have the idea that your directions were to go ahead, water or no water. I wish you would explain just exactly what you meant by your testimony in that regard.

A. I always explained to the Committee, or endeavored to, that the advance could not be made without adequate pumping apparatus, after striking water,—without considerable pumping apparatus. The matter was discussed whether an order had better be given to supply pumping apparatus or not, and the council determined, I think, that it would not be expedient to direct as to the details of the prosecution of the work in that way, but to order the work to be pushed, and hold the contractors responsible for the result attained, and let them apply their own apparatus as they saw fit. They understood fully that the work could not be done without additional apparatus.

Q. (By Mr. CUMMINGS.) The council understood so?

A. Yes, sir.

Q. How did they get that understanding?

A. By my explanation to them, that the work could not be done without further apparatus.

Q. Did you explain that to them before the water was encountered, that the work could not be pushed?

A. Not before they met the water, because the question had not come up then; no urgency was required before they met water. Mr. Shanly was perfectly willing to push that point before he met the water, but if Mr. Shanly had moved with alacrity to put in additional pumps, instead of attacking the wet heading without the pumps, it would have been more in accordance with the expectations of the council and myself.

Q. Well, do you think that before he met this wet heading he should have gone ahead and put in pumps?

A. Well, it was not for me to say what he should do or should not do. I can tell what I should have done, under the circum-



stances. He was responsible for the results, and it was for him to find his own means for attaining them. If I had been in his place, after making that agreement, I should have perfected plans for pumps of two or three times the capacity which he put in, and developed those plans in action gradually, one at a time, in advance of their need, as far as possible, in order to keep a margin of machinery ahead of the need. I think that would have been the best economy. No man pumping water can work his pumping apparatus up to its full capacity with economy. It not only overtakes, inevitably, the apparatus, and renders great delay liable, but the risks are great. There always should be a large margin of pumping apparatus, because repairs are inevitable, and the risk of delay is great.

Q. That is, the governor and council ordered him to go west on your recommendation?

A. They did so directly after my recommendation, and, I suppose, in consequence of it. I was their professional adviser.

Q. You knew at that time how much water was coming in?

A. I did. I knew there was a fair chance of meeting it with another pump like the one he had, and the result proved so.

Q. (By Mr. TRAIN.) Was there any cause of complaint later than this,—that is, cause of delay on the part of the contractors, which affected their use of the Haupt Tunnel?

A. I think, after joining the headings, and having a surplus of men, if they had not discharged their men quite so rapidly, they might have hastened the completion of the Tunnel so as to have left very little work necessary to be done at the west portal, in discharging material, after the Haupt Tunnel was destroyed.

Q. Did you communicate with the governor and council in reference to that matter?

A. I wrote the governor in November, 1873, on the subject, just about the time they were joining the last headings.

Q. (By Mr. MOSELEY.) You mean the headings between the central shaft and the west end?

A. Yes, sir; the last headings.

The letter referred to was read, as follows:—

NOVEMBER 21, 1873.

To His Excellency WM. B. WASHBURN, *Governor, and the Honorable Council.*

I beg to call your attention to some facts in relation to the state of progress of the work at the Hoosac Tunnel, and the proper course to be taken to insure its early completion. By Mr. Frost's returns I find there remained to be done, on the 1st of November, the following amount of

work in the removal of solid rock ; viz., 36,303 cubic yards. The month of October accomplished the excavation of 4,782 cubic yards. If the work could progress at this rate till its completion, a period of  $7\frac{6}{10}$  months would be required. But the surface to be worked over will be continually narrowing down, rendering it more and more difficult, as time passes, to prosecute the work with the rapidity now practicable.

I should consider an average of two-thirds the above rate, say 3,300 cubic yards per month, quite as large as is likely to be attained through the whole period ; so that some eleven months would be required at such an average rate. Even then there would remain a considerable amount of trimming to be done. I find that out of the whole length of 25,031 feet there are at the 1st November only about 10,000 feet actually trimmed to full size, and there remains about 11,000 feet of length to be trimmed, and some 4,000 feet, on which a partial trimming has been accomplished. I find that, by referring to the force account, there was employed, January 1, 1873, a total of 827 men, while on the 1st of July the force was reduced to 762, and on the 1st of this month is further reduced to 635. If this reduction be allowed to continue, it is difficult to predict what further time may be consumed in completing the work. I am well aware that the *bulk* of the work may be done in seven or eight months, but that will be very far short of the completion to *full size* and the arching of the dangerous places ready for use. I would, therefore, urge that the contractors be required to employ an additional force, rather than to continue diminishing their number, and particularly now the two headings are about to be joined, that the men so employed be not allowed to scatter.

Respectfully, yours,

EDW'D S. PHILBRICK, *Consulting Engineer.*

Q. (By Mr. TRAIN.) Do you know whether that was communicated to the Shanlys or not?

A. I do not. I know there was some letter written. I don't know whether a copy of that was sent or not.

Q. Was the force kept up, or was it diminished after that, or did they increase it and carry it up to their original amount?

A. They kept rather more men on the trimming after that, so that that was brought up to the mark ; but I am not familiar enough with the record of force account to know whether they did actually diminish their force or not. That is a matter of record.

Q. How would that affect the use of the Haupt Tunnel?

A. As I have said before, the Haupt Tunnel had been lying out of use for some time, but there was considerable material to come out near the west shaft, which had been left there for years, and I often urged that a force ought to be put upon that, and that some of those spare men should be put upon that earlier than they actually were, because there were a thousand feet of enlargement to be made there which was left to a very late day. A part of that

material had to be hauled out of the Haupt Tunnel after the western shaft was abandoned. I think if that material had been taken down earlier, the Haupt Tunnel would not have been needed after its interruption by the State—wouldn't have been needed at all.

#### CROSS-EXAMINATION.

Q. (By Mr. ALLEN.) Did you consider that they had a legal right to the use of the Haupt Tunnel during the whole term of their contract?

A. I supposed they had, during the whole period of their contract.

Q. (By Mr. CUMMINGS.) Do you agree with Mr. Frost in relation to the sinking of the central shaft being an economical and judicious measure, in order to complete the Tunnel?

A. I think if I were to plan the work over again I should advise no shaft.

Q. Will the shaft be of any use as a ventilator of the Tunnel?

A. That is a matter of experiment. They have plenty of air, nine months in the year, without it; have a great deal more than they want in the winter, and have to fence it out. The Mt. Ceniz Tunnel, which has been used now for several years, has no shaft. It is nearly twice as long as the Hoosac Tunnel, and they have had no trouble about ventilation. That is the only example we can give; the only precedent of the kind.

Q. (By Mr. ALLEN.) Hasn't the opinion of engineers, generally, changed as to the expediency of a central shaft?

A. Well, I really don't know what it was, nor what it is now, except as I have heard it expressed by a few men with whom I have conversed upon the subject. I think it hasn't been discussed very generally among engineers.

Q. You speak of the shaft as a means of ventilation?

A. As a means of economical construction, I was first asked. It saves a certain amount of interest in the completion of the work, inasmuch as it may have hastened its completion.

Q. (By Mr. CUMMINGS.) How much did it hasten it?

A. I haven't computed it exactly.

Q. How much should you think?

A. Some months, certainly.

Q. Mr. Frost said a few months.

A. Yes, sir; it did hasten it a few months.

Q. (By Mr. TRAIN.) With proper pumping apparatus, it would have hastened it much more, would it not?

A. Yes, sir; if \$50,000 more had been spent upon the pumping apparatus it would have hastened it some months more.

Q. How many, should you think?

A. Perhaps three or four.

Q. (By Mr. TRAIN.) There would have been no difficulty in keeping up the rate of progress prescribed by the contract, would there?

A. There wouldn't have been, after he got the machinery in. They have to get a certain amount of room by hand-work before they can apply their machinery, and the hand-work would have been slower than the contract rates.

Q. (By Mr. CUMMINGS.) You say you would have prepared your pumps on paper; I don't know what that means.

A. I mean, planned them thoroughly.

Q. After they met the water, having the plans prepared on paper, how long would it have delayed them to take the pumps off the paper and put them in there?

A. I don't think it would have been any serious delay in the workings, because they hadn't begun to apply the machinery then. They were blasting by hand.

Q. You think they wouldn't have had to stop work if they had made the plans as you suggest they should have done?

A. They would have had to interrupt the hoisting, more or less, but I don't think the mining would have been seriously interrupted at the headings. The hoisting would have been interrupted; but they were able at that time to hoist several times as much as blasting by hand-drills could accomplish, and if the hoisting apparatus was delayed for a time, it would have been fully adequate in the remainder of the time to relieve the Tunnel of all the material which the hand-drills could blast out. The hoisting apparatus was adequate to clear the Tunnel, not only of water and what the hand-drills could blast out, but of what eight sets of pneumatic drills on each side could blast out, as the result afterwards proved.

Q. Then you would say, that if they had prepared these plans on paper, the putting in of the pumps would not have delayed the work scarcely at all?

A. I think, scarcely at all, if they had been properly planned beforehand, and put in a little in advance of the apparent need.

Q. (By Mr. HOLDEN.) I understood you to say that you had examined the Tunnel pretty thoroughly in regard to arching?

A. I did, last July.

Q. What explosive agents were used in the Tunnel, principally?

A. They began the use of glycerine long before I saw the Tunnel, long before Mr. Shanly took it, and it has been very generally used ever since wherever it was found economical. At certain



points it wasn't used, because it was found that gunpowder was more economical.

Q. Did you notice any difference in regard to the necessity of arching where glycerine was used instead of gunpowder?

A. Other things being equal, where glycerine was used on the roof, there is a more shattered appearance to the rock; but I think the effects of glycerine would not alone require arching; the rock would require more trimming; a more careful examination of the roof would be necessary, and cutting down the loose scales; but it wouldn't interfere with the character of the work to such an extent as to require arching, if the rock was otherwise sound.

Q. What proportion of the rock has been tunnelled by the use of gunpowder?

A. I haven't got the data to make that up.

Q. Did they have to arch where gunpowder was used at any points?

A. I am not familiar enough with the exact points where gunpowder was used to know to a certainty; but my impression is, from what I know of the rock, that no manner of explosive agent would save some of those bad places, no matter how tenderly the rock was attacked; the trouble goes a great deal further than the influence of the explosive agent.

Q. (By Mr. ALLEN.) You approved of the use of some more powerful agent than gunpowder?

A. I think the Tunnel would not have been finished in this generation without the use of glycerine.

#### TESTIMONY OF GOVERNOR TALBOT.

Q. (By Mr. TRAIN.) You were lieutenant-governor in 1873.

A. Yes, sir.

Q. And as such, chairman of the committee on the Hoosac Tunnel?

A. Yes, sir.

Q. You have heard that letter read by Mr. Philbrick; in consequence of that communication, did you address any communication to the commissioners?

A. I did. I addressed a communication to the commissioners upon either that letter, or one of similar import; I don't remember about that. I think the letter Mr. Philbrick wrote me at the time was written at my suggestion, because he came up and was complaining that sufficient progress was not made, and I desired him to put it on paper in the form of a communication, and he did. I presume that is the letter.

Q. Is that the reply of the Messrs. Shanly to the letter which you sent? [Letter of November 29, 1873.]

A. I think it is, sir.

MR. TRAIN. This letter acknowledges the receipt of Governor Talbot's letter of the 21st inst. I only want to read the last clause of it:—

“In reference to the latter part of your letter, while receiving with all proper deference and respect, not alone the protest of the committee against further reduction of, but also the insistance to increase, our force in the Tunnel, we must assert our right to do our work in our own way. From the outset of our undertaking here we have firmly and unwaveringly pursued our own course, often in the face of much opposition, and we feel sure, sir, that you and your associates on the committee will, on reflection, allow that interference with our rights in that direction, even if admissible and equitable, is not called for.”

Q. Had it been a matter of complaint in your interviews with them that they were not doing their work as required by the contract?

A. Whenever I had interviews with Mr. Shanly, I have talked this work over, and said everything I could in the direction of pushing the work forward; but my communications were more frequently with the engineers, especially Mr. Philbrick. He reported, and also Mr. Frost, probably twice a month, and I communicated with Mr. Philbrick quite often.

Q. You also saw Mr. Shanly once a month?

A. No, sir.

Q. Wasn't he down every month?

A. I didn't see him every month.

Q. How often do you think you did see him?

A. I don't think I saw Mr. Shanly oftener than once in three months.

Q. How often were you and the other members of the committee at the Tunnel?

A. Not more than two or three times a year, I think; perhaps three or four times during the year. I can't say positively.

Q. But you relied substantially on Mr. Philbrick and Mr. Frost for your data on which to conduct the business?

A. Yes, sir. Mr. Philbrick was appointed as the advisory engineer of the governor and council, and we expected he would make visits there frequently enough to thoroughly inform himself of the condition of the work, and report in detail to the governor and council frequently; and he did, very often.

Q. Were you in the council in 1869, at the time this contract was made?

A. Yes, sir.

Q. Did you undertake to make a contract for the entire completion of the Tunnel, fit for use, with the Shanlys?

A. Yes, sir.

Q. Did the Shanlys so understand it?

A. I think they did. I think they understood it perfectly. I remember very well a conversation that took place at the time among all the parties, and I know that was the general understanding. I think Mr. Shanly stated, when inquired of whether he had informed himself sufficiently to take such a contract, that he had informed himself as well as he could of the character of the rock from reading Hitchcock's reports, etc., and that he had informed himself as regards the estimates of the engineers sufficiently to be satisfied. That is the way I understood it at the time,—that he fully understood what he was about when he took that contract. I know that the purpose of the governor and council, the commissioners, the engineers and the attorney-general of the State at that time was to make a contract that would warrant the completion of the Tunnel for a given sum, and if they did not do it, it was because they did not know enough to do it. That was their purpose.

Q. That was what you understood the statute of 1868 to mean?

A. Yes, sir. We found that we had an appropriation of \$5,000,000 and seven years' time to complete the Tunnel, and our purpose was to make a contract to do it within that sum and within that time, if possible. That was the object that governed the authorities at that time.

Q. Were you in the council in 1869? That was the first year of Governor Claflin.

A. The first year of Governor Claflin, I was.

Q. Were you on the Tunnel committee that year?

A. Yes, sir.

Q. Was there any complaint of lack of energy on the part of the contractors during that year? That was the year of the great storm.

A. I remember this whole question about the effect of that storm upon Mr. Shanly's contract and his working. I remember perfectly well about that. I don't remember whether there was any conversation especially about the rate of progress.

Q. Then, were you in the council in 1870 and 1871?

A. I was in the council one year under Governor Claflin.

Q. And then you were out until you came in as lieutenant-governor?

A. Yes, sir; I was out three years.

## CROSS-EXAMINATION.

Q. (By Mr. ALLEN.) Did you reply to this letter of the Messrs. Shanly of Nov. 29, 1873?

A. No sir, I did not; at least I don't remember replying to it.

Q. Do you remember, governor, whether there was any other subject treated of in your letter to him to which this letter was in reply than the subject of brick arching?

A. Yes, sir. In substance, it had reference to this communication from Mr. Philbrick in relation to the number of hands, the diminishing work, and the quantity of work yet to be done. Mr. Philbrick furnished me the data.

Q. I didn't mean to ask you in detail the contents of the letter, because I dare say Mr. Shanly can find it by examination, but I would like to ask you whether, assuming the Messrs. Shanly to have lost \$225,000 in the execution of their work, and without any reference to any legal considerations or obligations under that contract, one way or the other, you think it would be right for the State to make it up to them?

Mr. TRAIN. Supposing he does,—do you want to employ him as a lobby man?

Mr. ALLEN. No, sir; I don't. I want to ask his views as a gentleman who has had a thorough acquaintance with this work.

A. All I can say is, that if I employed a contractor to build a work for me, and if he satisfied me in the end that he had met with unforeseen difficulties, and satisfied me that he had lost money, I should feel it my duty to take his case into consideration, and should of course make him what I believed to be an equitable and proper allowance. That is the view I should take of it.

Mr. ALLEN. Well, sir, I don't know but that amounts to an answer to the question, though I had hoped for a more direct one.

Mr. TRAIN. I understand Governor Talbot to say that he always means to do the fair thing himself?

WITNESS. I don't feel myself to be an expert on anything of that kind, sir. I do not know that this Committee would call upon me to give any advice in that direction.

Mr. ALLEN. I thought you had been pretty familiar with the conditions of this work from the beginning, and knew generally the difficulties the contractors had had to encounter, and the energy which they displayed in overcoming them. If you are willing to give an answer to the question whether, without reference to legal questions, one way or the other, you would think it was right to make up their actual loss to them, I should be glad to have you.

A. I never made up my mind fully, until I heard Mr. Shanly's



testimony, the other day, that they had lost money from the working of the contract; but I have felt, from my observation of the progress of the work, that Mr. Shanly perhaps might have given it more personal supervision. Mr. Shanly stated before the legislative committee once that he was paying interest on \$750,000, and it required a great deal of his time and attention, that ought to be given to this contract, to keep his financial affairs in good condition, and I felt that some of the delays in pushing this work along were due to Mr. Shanly's want of capital; but I do think that under all the circumstances, taking all the difficulties that he has met with, Mr. Shanly has shown a great deal of pluck in putting the thing through.

Q. Considering the two seasons of financial panic which we have passed through in 1872 and 1873, did it not, on the whole, show a good deal of strength on his part to have been able to get through with it at all?

A. Yes, I think it did. I think those who knew Mr. Shanly had confidence in him, had faith in his statements and in his integrity, and that he did, under the circumstances, as well as he could.

Q. (By Mr. CUMMINGS.) I would like to ask in relation to the final settlement by the governor and council, were any items of the Messrs. Shanly disallowed on account of the understanding that they were coming to the legislature?

A. There were one or two items,—I do not remember now which they were,—with regard to which the remark was made to Mr. Shanly, that the governor and council perhaps had allowed all they felt they had perfect authority to do, but there were one or two items which, if he would not go to the legislature, they might try to stretch their authority so far as to allow them, on the ground that they would be consulting the interest of the State in doing it.

Q. Do you remember what these items were?

A. I do not know now, without referring to a memorandum. I think one was in relation to the use of the Haupt Tunnel. There was some feeling in relation to the damage resulting from that storm, and also on account of the delay in the use of the railroad for a few months, the railroad being closed for a few months after the storm of 1869. I felt that there was justice in some of Mr. Shanly's claims; that there were difficulties which he could not have foreseen.

Q. You were chairman of the Tunnel committee at the time this order was issued for him to go west, when he met the water?

A. No, sir. I was not in the council at that time.

Q. (By Mr. ALLEN.) In making your settlement with him, you

would feel under a general obligation to restrict yourself to legal considerations, would you not ?

A. Yes, sir.

The CHAIRMAN. He could not go outside of them much. The presumption is that we do illegal things here.

WALTER SHANLY—*Recalled.*

Q. (By Mr. ALLEN.) How much water was coming in when you first found it necessary to suspend work, in March, 1871?

A. There was about 80 gallons per minute coming in.

Q. What capacity of pumping-power had you provided when you resumed work in November, 1871?

A. The pumping capacity then was up to about 200 gallons per minute, by *forcing* it.

Q. Did you expect that to be sufficient to deliver all the water you were likely to encounter thereafter?

A. Yes, sir, we expected it to be amply sufficient, on the plan that we meant to pursue.

Q. What was that plan?

A. Our plan was, not to attempt to enter the wet rock in the west heading any further, until we had formed a connection eastwards, and so obtained drainage.

Q. When could an opening east have been effected, if your plan had not been interfered with?

A. We might have effected that opening, I should say, early in October, 1872. As a matter of fact, it took place on the 12th of December after that.

Q. In that case, when could you have joined the westward headings?

A. We could have joined the westward headings, I should think, easily enough, in September, 1873, assuming that we had been able to get into it in October, 1872?

Q. At the regular contract rate of progress, had nothing ever interfered to prevent it, when would the western headings have met?

A. Well, the calculated time for the meeting of the western headings, supposing there had never been any interruption, was the first of July, 1873. That was the time that the engineers had originally calculated, if everything had gone on as it was supposed it would go on,—that on the first of July, 1873, the final joining of the headings would have taken place.

Q. So that, with all the delays you were troubled with, you would have been only three months behind in joining those headings, if you had been allowed to work your own way?

A. Hardly three months, I suppose; short of three months.

That is to say, we should have got a union of the western headings some time in September, 1873, instead of, as was calculated, the 1st of July, 1873.

Q. What was the total advance made in the west heading from November 17, 1871, when you were first instructed that it must be driven, water or no water, until your last suspension of work on the 22d of May?

A. The progress we made in the west heading, from November, 1871, until we finally suspended that heading on the 22d of May, 1872, was about 144 feet.

Q. What increase of water took place in that period, and in this advance of 144 feet?

A. The increase of constant flow of water in that period and in that space, was about 130 gallons a minute. It ran up from about 80 gallons to about 213,—133 gallons of increase.

Q. How much of that 144 feet advance was made after you received the order of the 2d of March?

A. Only a trifling advance in the heading. We got about 17 feet further in the west heading between the 2d of March and 22d of May.

Q. How much of the 133 gallons referred to, as the total increase since the 17th of November, was made in that last 17 feet?

A. Just about half; just about 65 gallons were made in that advance. In the advance in May, we gained an increase of 65 gallons.

Q. Suppose you had stopped work on the 2d of March, and put in a second large pump, as the engineers advised, how much water would you have had to deal with by working both headings west?

A. We would have had to pump a constant flow of about 350 gallons. There was that much made in the Tunnel that we would have had to deal with and bring to the surface. But that was the constant flow. We would occasionally have had to bring to the surface probably 400 or 500 gallons, because there were pockets of water struck and occasional accumulations, when something would stop the engines for a time. There is no such thing as perpetual motion. The pumps must stop sometimes for repairs; and if we had driven both heads, we would have had to lift 400 or 500 gallons a minute occasionally, because the constant flow reached 350 gallons. We would have had to have three of the largest pumps in there to meet the water actually met with in those headings.

Q. Have you any particular memorandum to gauge the flow of water at any particular time?

A. Yes, sir; we struck a very heavy stream of water on the 21st of June, 1873,—a very heavy stream of water, indeed,—some 1,200

gallons, or thereabouts, west of the central shaft; and on one occasion I took account of the water we were pumping there,—not up the shaft, because at that time we were through to the east end, but over the bench,—and we were pumping upwards of 500 gallons per minute. That pocket did not last; but that same pocket, which gave us so much water at first, brought us a constant accession of 50 gallons per minute. But that 500 gallons, that large excess of which I speak, was pumped out in two or three days, and then we had the constant flow increased by about 50 gallons a minute.

Q. And if you had provided pumping-power, as the engineers suggested, the capacity of the two large pumps would have been, how much?

A. The safe capacity of the two large pumps would have been about 290 gallons per minute, running them at ten strokes per minute, which was as much as it was safe to run them without danger of breakage—145 gallons each.

Q. So that you would have had some 60 gallons a minute more to deal with than the capacity of the two large pumps?

A. Yes, of constant flow; but while our pumps were going at an excessive rate, 12 strokes per minute, we have sometimes lifted, for eight consecutive hours, as much as 40 gallons a minute by buckets, by baling, besides.

Q. Supposing two large pumps to have been put in, how many more pumps could you have put into that shaft?

A. We could not have put a third pump in there without very much impeding the use of the hoisting machinery as a means for raising rock.

Q. What was your reason for intending not again to resume work in the west heading, after you got your large pump going in November, 1871, until after you had succeeded in getting an opening east?

A. Because the only fact on which we could base our calculations, was that the rock was yielding a great deal of water, and as no human foresight could tell how much water we might meet, we thought that the only safe and wise course, not only for ourselves, but for the Commonwealth also, was to delay that west heading until we had a certainty of drainage through the east workings.

Q. How did it happen that you did not act upon that order of council of June 14, 1872?

A. Well, it was not pressed. We had two interviews with Governor Washburn and the council. We had first an interview on the 20th of June, after that order of the 14th; that was adjourned, and we had a second interview on the 28th. I then, myself, personally represented to Governor Washburn, previous to the



meeting, the great risk that was run, if we were forced to go on with the west heading, of filling the shaft with water. I have always held the opinion, and do still, if that shaft had once filled with water, it would be full of water to-day. I hold to that opinion, and therefore, although the order was not rescinded, as far as I know, we were tacitly allowed to carry out our own plan.

Q. (By Mr. CUMMINGS.) What do you mean—that it would have been full of water to-day because the work upon the Tunnel would have had to be stopped?

A. I think the Tunnel was a thing that Massachusetts was pretty well sick of; and I believe that, if the shaft had once filled with water, it would have been said, by a great majority of the opponents of the Tunnel, "It is useless to undertake to go any further; let it stop where it is." It would have been a very expensive process to get the water out, because we had not got drainage at the east end, and the whole of it would have to be taken out from the top; and those who did not want to see the Tunnel built, in the legislature and elsewhere (and we all know there were certain parties opposed to the Tunnel), would have been glad of the opportunity to say, "It is useless; let the thing go." It would, at all events, have immensely strengthened the hands of the people who were opposed to the Tunnel. Everybody knows that the Tunnel was a vexed question in Massachusetts for several years. Even the friends of the Tunnel, I have found, up to the time when we joined the headings, had a sort of unbelief that it was ever going to be completed.

Q. (By Mr. MOSELEY.) If this large flow of water, of which you speak, had occurred before you had made the connection between the eastern heading and the central shaft, would it have filled the shaft, at any rate?

A. O, undoubtedly, even if we had had two pumps in,—undoubtedly.

Q. Then, the only reason why it was not filled, was because you had been fortunate enough to progress so fast?

A. Yes, eastwards.

Q. (By Mr. TRAIN.) So that you could pump it over the bench?

A. Yes, sir. Instead of lifting it 1,000 feet, we had only to lift it 15 feet.

Q. (By Mr. FISK.) How much more water would the pump lift 20 feet than it would lift out of the shaft?

A. It would lift fifty times as much over the bench, with the proper power. The cost of pumping is exactly as the height. There was no trouble in throwing 500 gallons of water over that bench; 1,000 gallons would not have troubled us over the bench at all.

Q. (By Mr. CUMMINGS.) You say, if the shaft had filled with water, it would have been full of water to-day, and you give us the reason for that opinion, that the people would not have gone on with the work. Could you not have gone on and bored through from the east to the west heading, and relieved it in that way?

A. How would you have got it out?

Q. Left it in there.

A. When you got to it, who would venture to tap it? There was this enormous column of water, 1,010 feet deep. You never could have found a miner who would be willing to go in there and tap that water.

Q. Do you agree with Mr. Philbrick, that the Tunnel could have been built more economically without the central shaft than with it?

A. I am quite sure of it.

Q. Do you think it will be of any use as a ventilator?

A. Very doubtful use. For the greater part of the year, it will be of no use. There may be periods during the year when the shaft will help ventilation; but I think that, as a ventilator, it will prove to have been too expensive for any good it will do.

Q. (By Mr. HOLDEN.) Are we to understand you that the water in the central shaft could not have been tapped at the bottom?

A. It might have been worse than the Williamsburg disaster, last year. No person would venture to tap it.

Q. (By Mr. FISK.) That would depend upon how large a vent it had, would it not?

A. Yes; but who would run the risk of making even a small vent?

Q. Could not a train be laid, and sufficient time allowed for the man to get out of the way of the water?

A. It would be very hard to get anybody to try it. I think I should want to get out very fast. It would be a very great risk, indeed.

Q. (By Mr. MOSELEY.) How far would a man have to travel to escape from this water that was after him?

A. He would have to travel two miles and a quarter.

Q. Could he not have a fuse outside of the Tunnel?

A. Possibly; but the people outside would have had to clear, too, I think. There would have been a great risk; and if it was known that the shaft was full, it would be understood that it was dangerous, and it would have been left full. That is my belief.

Q. (By Mr. TRAIN.) When you say, "full," do you mean clear up to the top?

A. No; I said 1,010 feet. The real depth of the shaft is 1,030 feet.

Q. Substantially, the water would come clear to the top?

A. Yes, sir; within 20 feet of the surface. There was a little outlet 20 feet below the surface, where the water could be let off.

Q. (By Mr. FISK.) Do you think it would come clear to the top?

A. Certainly. The springs, evidently, had a very high head. That was quite evident, because the water used to spurt with immense force from those holes when we struck water, even after we had plugged them.

Q. (By Mr. TRAIN.) In fact, the pocket to which you have referred was the only great quantity of water you found?

A. We found various quantities at different times; but that was altogether the greatest.

Q. And that was not until after you had joined the headings?

A. No, sir; but it would have been previous to that, if we had been working both ways at once, you know.

Q. You understand, that the governor and council never proposed to stop your working eastward as fast as you chose?

A. O, no. They wanted us to work both ways.

Q. You cannot reckon this pocket, then, as a contingency after you had got your east heading opened?

A. Not that. I am not complaining of that.

Q. This was after you had got your east heading opened?

A. Yes; but it would not have been so, if we had been working both ways, *pari passu*. If we had been carrying on the west heading at the same time we were carrying on the east heading, we should have struck this water before we had joined the east headings. The day we struck that water, we should have been here [indicating on diagram].

Q. Do you mean to say that it was not possible for you to supply sufficient power to take care of that water, even on that state of facts?

A. Quite possible, but not without filling the shaft so full of pumps that it would have been practically useless for hoisting purposes. The great object of the shaft, as a means of advancing the Tunnel, was as a means to bring up rock, not water.

Q. Supposing that order of June 14 had been enforced, what course should you have pursued?

A. We would have stopped work. We had made up our minds to that. We could not go on. We would have stopped the work then and there, as a matter of necessity. Our estimates were to be stopped. We had been carrying a heavy load of debt previously,

and had no further means. We would have had to stop, of necessity.

Q. (By Mr. MOSELEY.) Do you mean to say you could not get any more money?

A. Yes, sir; that was the order of the council of June 14, 1872, that no more estimates were to be paid us unless we went west; and I wish to repeat here, that that order was not enforced because of our representations to Governor Washburn. The real danger that we saw ahead was the filling of the shaft, and we wished distinctly to say, that if that happened, we were not responsible. Therefore, that order was not enforced.

Q. When that order was given, did you begin to work west again?

A. No, sir; we did not do it. We had made up our minds not to do that, whatever happened. We were determined not to do it, because we couldn't do it; because, if that order had been enforced, it would have been accompanied with one of two results, either of them ruinous to us. If we had gone on, with that 70 gallons a minute flowing into the shaft, beyond the capacity of our pumps to meet, all the appearances were against our being able to free the shaft. If we had refused to go on, the council would have stopped our estimates. In the one case, the water would have ruined us; in the other, the council would have ruined us. The only difference in our favor by stopping was, that we thereby saved further expenses. If we were to go on, we would have to furnish the money to pay our men, and for other outlays.

Q. (By Mr. ALLEN.) In your former evidence on this subject, I believe you said that 320 gallons a minute was the greatest quantity mentioned in Mr. Wederkinch's statement ever pumped up the central shaft?

A. Yes, sir. I wish to correct that, however. What I meant to say was, that we would have pumped up that much if we had worked westward all the time. We never did actually pump up that 320 gallons. On looking over the report of the evidence, I saw that it was put down that we had pumped up 320 gallons a minute to the surface; but we did not. What I meant to say was, that if we had been forced to continue to work westward, we should have encountered 320 gallons to be pumped up to the surface. As a matter of fact, according to Mr. Wederkinch's own statement, we should not have encountered a constant flow of 350 gallons before we would have had drainage to the east.

Q. How long a time would have been required to put in a new set of pumps of the size of your large set?

A. Well, the putting in of the pumps would have to be supple-



mented by erecting engines, boiler-houses and boilers. I would not undertake to contract to do it myself, supposing it was apart from any portion of the work, under six months.

Q. Won't you explain to the Committee the necessity of working up instead of working down grade, in going east from the central shaft, as you did in 1872?

A. I think the first day I was before the Committee, I exhibited this section. We worked up, because the water was forever threatening us to come up *here*. Whenever a cog-wheel broke, or anything required repairs, the water would immediately gain on us rapidly. We were working in this heading, and should have been working down *here*; but as a matter of fact, as stated by Mr. Frost and Mr. Philbrick, we worked up that way. It was not entirely level *here*, but we run up a little above the level, because, if we once got the water into this place, we would have had, at a distance of a thousand feet from *here*, five feet of water in the heading. The water was gaining upon us at the rate of six inches in every hundred feet. Mr. Philbrick says he has some way (I don't understand what) by which he could have got rid of the water, supposing the heading had so filled, in a couple of days. Well, I don't see how it was to be done, because there would have been 400,000 gallons to begin with, while there were 60 or 70 gallons a minute coming in all the time besides.

Q. (By Mr. HOLDEN.) Couldn't it have been dammed up to stop it?

A. Then you couldn't get out the stone. We should have had to stop the works. We were gaining, besides the water that would be in there, 65 gallons a minute.

Q. Of course, I don't mean to fill up the whole space with a dam, but sufficient to stop the water?

A. We didn't know how high it would get.

Q. (By Mr. ALLEN.) How high did it get?

A. It came up over *here* sometimes. We put in a little dam to prevent the water from running back.

Q. You say it actually came up above the level?

A. Yes, sir. I have gone in with a boat where the water was so deep that the boat could float over that edge there, but, of course, it didn't do us any harm, because we ran up above the level, as I have said.

Q. If you had been going down, what would have been the result?

A. If we had been going down it would have filled us up inevitably. Mr. Philbrick spoke of there being a little water "trickling" in. It seemed a little trickle to a person going in there now and again, perhaps, but in advancing the heading a thousand feet, there would

have been considerable water coming in by "trickling." I have great reliance on Mr. Wederkinch's reports, and, according to him, the "trickling" was 65 gallons a minute.

Q. (By Mr. MOSELEY.) Did you have the feeling that the engineers were working in co-operation and sympathy with you, or working against you?

A. I think the whole contract was always interpreted against us in the severest possible terms. I would prefer not to have had the question asked me, but as it has been asked, I will answer it. I always felt, I was always made to feel, this, "You have got to follow that specification. Fail in the Tunnel if you will, but if you do, you must not fail in carrying out the specification." That was what was always dinned into me. "You must follow that specification, even if it should be destructive of the ultimate progress of the Tunnel."

Q. (By Mr. FISK.) That was when any difference of opinion arose between you and the engineers?

A. Yes, sir. Whenever there was any difference of opinion, that was the claim made upon us, "There is the specification, and you must work up to it."

Q. Were there not any portions of the work where you didn't carry out the specification?

A. Where it was possible to carry out the specification, we never hesitated at all. This was the only point where we didn't carry it out ultimately.

Q. Then why do you say that claim was "always" made upon you, when this was the only point?

A. There were several points, from time to time, as we went on, where there was a difference of opinion, and we yielded; it wasn't worth while to contest it.

Q. The others were mere trifling matters?

A. Yes, sir, comparatively.

Q. (By Mr. ALLEN.) Whether in coming east, in 1872, the accumulation of that quantity of water, as you have described, was an impediment to the progress of your work?

A. O, a frequent impediment.

Q. In what way?

A. We had to run buckets sometimes for eight, nine and ten hours at a time, which was the cause of very great delay. There were numberless and nameless ways in which hoisting the water by the machinery that should have been employed in hoisting rock delayed us. We were also delayed by being obliged to fill the heading up with rock. The bench down here wouldn't have held anything like the quantity of rock taken down. We were obliged to fill the

heading up so that there was only just room enough left for the cars to go along, and that impeded the work very much. This place *here* wouldn't have held a fourth part of the rock that we took out during the months we were not hoisting.

Q. (By Mr. FISK.) Did you hoist it all off of the bench?

A. No; half of it, about. As soon as we joined *here*, we had our eastern gangs come up and run part of it away eastwards; but in order to do that, we had to do the work in that way. [Mr. Shanly at this point made a sketch, and explained, by means of it, the method adopted to remove the material.] You see we had this water all the time to pump over the bench. We took it out that way.

Q. So that, virtually, after you made that bench, you didn't have to hoist but a small part up the shaft?

A. Yes, we hoisted not quite half of it.

Q. (By Mr. ALLEN.) At what time was the time for the completion of your contract extended?

A. We applied to the governor and council on the 25th of February last year (1874) for an extension.

Q. Won't you give us the particulars about it?

A. I think you were present with me on that occasion. Of course, it was a well-ascertained fact, after we lost seven or eight months in 1871, that that extension which the contract provides for in view of unforeseen difficulties would be asked for and granted. We relied upon that as a matter of course. On the 25th of February, last year, I made a formal application in person to the governor and council, and there was no hesitation in granting it. On that occasion the governor asked me, very courteously, if I wanted it put in writing, and I said, No, it was done in full council, and I didn't care anything about that. They always treated us henceforth as having that six months' extension granted to us.

Q. Mr. Philbrick referred to some conversation he had with one of your foremen in regard to taking down loose rock, in which that foreman told him that he hadn't directions to take down certain loose rock. This was on the occasion that Mr. Philbrick mentioned when some rock fell in the Tunnel. Do you recollect it?

A. Yes, sir. I think he said that ten tons fell on the scaffold. I don't think that any of my scaffolds were strong enough to stand a ten-ton fall, and I didn't hear of any scaffold being broken.

Q. What directions did you give?

A. Everything they could get down by bars and wedges, or by light blasting, was to be taken down, because Mr. Frost's instructions were that we must resort to blasting in order to take down loose rock, and we gave instructions accordingly, always stating that we didn't consider it our work to do.

Q. If the Haupt Tunnel had not been destroyed so that you were shut out from the use of it, when should you have abandoned the use of the west shaft?

A. We should have abandoned it about the latter end of last April.

Q. Mr. Frost spoke about a conversation that he had with you shortly after your contract was entered into, if I remember right, in reference to the condition of the 810 feet at the east entrance of the Tunnel,—do you remember it?

A. Yes.

Q. Won't you state your recollection about that?

A. There was never any conversation, so far as I remember, except that it was pointed out to us as a specimen of finished Tunnel; the Tunnel was to be taken out like that part. I was shown that 810 feet when I first went into the Tunnel, and was told: "There is a rock-section of completed Tunnel; we want the rock-work done like that."

Q. When did you first learn that you were expected to do any work in that distance?

A. May 18, 1871, was the time when I first heard that that portion was not finished Tunnel.

Q. As to the embankment which you were called on to make for the county road, will you state if there was any difficulty in doing the work as they directed you to?

A. Well, it was more difficult than the railroad embankment. Of course, when we took the Tunnel, the understanding was that the rock was all to go across the Deerfield River for the railroad embankment; we knew nothing about this county road at all; we never heard of this road embankment. But when they came to make this county road, they called upon us to put the rock upon the south side of Deerfield River to make this road. There is a clause in the specification that requires that we shall deposit the rock wherever required by the engineer, and we made no question about it. We said, "Yes, all right; we will do so; but the extra expense that we are put to in running down this steep grade we claim we ought to be paid for." We couldn't run it down *here*. Our engine was greatly injured, and we lost several cars down the bank on dark nights, even by running it down so far. The only practical way we could do that was just to run our engines and cars as steep as it was safe to run them, and then we set to work and carried the material out by hand-work, taking it off here and filling in below, leaving only as much to come off here as would fill in below, and we think that for handling that work down there, which couldn't be done by our rolling-stock, we ought to be paid. It is



only about \$680. We charge exactly what it cost us. We didn't care to do the work ourselves, and we got some tenders, and gave it to the lowest bidder, we furnishing the rails, cars and tools.

Q. That \$680 is included in the \$3,500, is it not?

A. Yes, sir.

Q. Now, in regard to that other portion of the item, the railroad embankment?

A. We were given to understand, when we took the contract, that the whole of the rock was to go across the Deerfield River. This [referring to profile] was the bridge across Deerfield River. The embankment extended some 2,000 feet towards the station. We were to dump the rock into the embankment. Now, dumping rock and grading rock are two different things. We held that if we put it reasonably near the eventual line of grade, without having any hand-work to do, we were doing all that could be reasonably expected of us. It would have been simply impossible to dump that rock from the cars and leave it perfectly graded for rails. We might leave it lower, and we did so in some places, but all along *here* we got it above grade, but not so much as is shown on the profile, because, as Mr. Frost tells us himself, subsequently to giving those stakes, he lowered the grade somewhat,—he didn't say how much,—causing this high part here to appear much higher than we left it originally.

Q. (By Mr. PRATT.) What portion of the \$3,500 is for making the road, and what portion for the other work?

A. \$683 was the cost of the road, and the total claim is \$3,500. About \$2,800 the grading of the railroad embankment cost. It was graded very wide, for two or three tracks; it is a very wide embankment.

Q. (By Mr. ALLEN.) Your charge, as I understand, is for handling the rock after it was dumped?

A. After it was put, as we held, reasonably near a level grade, which must be a true surface for them to lay their tracks on.

Q. With reference to the quantity of rock excavated outside the lines of the Tunnel, Mr. Frost has given a computation of the amount. Did you in the east end have a special contract for the excavation of some portion of the Tunnel there?

A. We had. Last summer the governor and council were anxious to get some of the Tunnel made ready, where the roof was bad, for the brick arch, and as we were then not doing much work in the Tunnel (we were waiting to get at the west end), we were asked if we would take the contract. They said, "As long as you are working here, we will give you the work of enlarging the Tunnel

for brick," and we agreed to do it, and did work during August and September enlarging certain places for brick-work.

Q. What amount of excavation already done was allowed for?

A. I don't know what amount already done was allowed for, but we were allowed two and a half yards per running foot for what we enlarged.

Q. Supposing the Tunnel had been excavated simply to the prescribed lines, how many yards would there have been?

A. Somewhere about eight yards to the foot. That would depend upon the thickness of the arch, but I don't think there would have been less than eight yards.

Q. So that it would leave from five to five and a half yards per running foot that you had already taken out?

A. Yes, sir.

Q. Mr. Frost stated that certain amounts had been reserved from your payments with reference to the trimming that was not done as well as they wished to have it done. Won't you tell how much was reserved?

A. I can't tell exactly how much without going all over the estimates; but at one time, when there was half a million of our money in the State treasury as security, they deducted \$27,000 for that item of trimming not being properly done. That was over and above the 20 per cent. always reserved under the contract. They took off \$27,000 one month, as they said, for additional security for this trimming.

Q. Were there any other reservations made from your payments?

A. They continued making their estimates in that way. They deducted at the rate of \$40 per cubic yard for trimming work. I can't tell what it eventually amounted to without going over the estimates. I only recollect that in one estimate they took out \$27,000. That was in 1871, I think.

Q. With reference to your personal attention to the business of executing this contract, won't you state what personal attention you gave to it?

A. We gave it all our time, literally, between us, for the first three years. If I was not there, my brother was. The last two years my brother hasn't been there, and I have been there almost altogether, I may say.

Q. (By Mr. MOSELEY.) Who did you have to look after the other parts of the work? You couldn't, of course, look after it all.

A. I divided the Tunnel into three sections for the purpose of carrying the work along in the most efficient way. We had a superintendent in charge of each point.

Q. Then the work went on, whether you were there or not?

A. Yes, sir. If I happened to be away a week, and found on my return that a certain quantity of work had not been done which I supposed should have been done, I wanted to know the reason why. We knew exactly, from month to month, what ought to be done, and if it wasn't done, we took care to know the reason.

Q. I should like to have you tell me what the lay of the ground is at the top of the central shaft, as I never have been there. What were the conveniences for removing the debris that you raised?

A. The facilities were not first-class. The central shaft is rather nearer the west end than the east; it is called "central" because it is nearly central. The whole lift from the bottom of the shaft to the surface was 1,030 feet, and we used to run the stuff off and tip it *here*.

Q. Where did you pump your water?

A. It ultimately got into that low ground there,—what is called "Cold River."

Q. That was sufficient to take it away?

A. O, yes, sir. We had an artificial cut to make it reach this hollow, but it ultimately got there.

Q. If you were to dig a well there, how far would you have to go to get water?

A. Well, I could hardly tell you that; but when they got half-way down the central shaft there was about 14 gallons a minute. We have good wells there without reaching rock at all. We built a house for the superintendent, and he has a beautiful well that is not more than 10 or 12 feet deep.

Q. In getting your machinery from either end, North Adams or Hoosac, what was the convenience? Do the roads wind round?

A. O, yes. You don't have to go over those summits, exactly; the road is rather lower than the summits, but practically the road just follows that line [on diagram].

[Adjourned to Wednesday, March 24.]

## MEMORANDUM OF AN AGREEMENT

MADE AT BOSTON ON THE TWENTY-FOURTH DAY OF DECEMBER, A. D. 1868, BETWEEN WALTER SHANLY, OF MONTREAL, AND FRANCIS SHANLY, OF TORONTO, CANADA, PARTIES OF THE FIRST PART, AND THE COMMONWEALTH OF MASSACHUSETTS, PARTY OF THE SECOND PART.

The parties of the first part hereby covenant and agree with the said Commonwealth to do and perform all the work necessary to complete the Hoosac Tunnel, with its central shaft (being a portion of the Troy and Greenfield Railroad), in accordance with the schedule hereunto appended, and furnish all materials, and lay down and complete, through the whole length of the Tunnel, one railroad track, and after the completion of the Tunnel and railroad track, to remove from the Tunnel all materials and other things, so as to leave the Tunnel and railroad track in complete order, ready for use, and to the satisfaction of the governor and council of the Commonwealth; the whole to be done by the first day of March, A. D. 1874, and for the sum of four million five hundred and ninety-four thousand two hundred and sixty-eight dollars (\$4,594,268), to be paid, together with any interest accruing under this contract, by the Commonwealth to the parties of the first part, their heirs, executors, administrators or assigns, in United States treasury notes, or other current funds, as hereinafter provided.

The size and general description of the work; the estimated amount of the same; regulations governing the manner of its performance; the rates of progress required in its prosecution; and various general and particular stipulations and provisions affecting and binding both parties hereto, are set forth in the schedule hereunto appended, which constitutes a part of this agreement. But no errors in the estimates of the work to be done and materials to be furnished under this contract, shall affect the contract price to be paid for the whole work.

The parties of the first part will provide suitable and sufficient materials and machinery, and a sufficient and competent working force, and enter upon the prosecution of the work as soon as possible after the execution of this agreement, and will keep on hand and in operation at all times every means necessary to an expeditious and thorough fulfilment of this agreement on their part, according to its true intent and meaning.



And whereas, in consequence of the stopping of the work at the several points of operation, and for other reasons, the parties of the first part may not be able at the commencement to make the rate of progress prescribed in the schedule hereunto appended, it is agreed that the governor and council may fix the time from and after which such rate of progress shall be made, and give notice thereof to the parties of the first part; which time, however, shall not be earlier than the first day of May next.

And whereas, that portion of the Tunnel which lies between the west and central shafts is expected to require a longer time for its construction than the other portions thereof, and difficulties now unexpected may arise, making it impossible to preserve the said prescribed rate of progress in other portions of the Tunnel, it is agreed that in case of necessity the governor and council may, by formal vote, determine what extension of time shall be allowed: *provided, however*, that in no case shall the final completion of the whole work be delayed more than six months after the first day of March, A. D. 1874.

And if, after a full and fair opportunity has been had by the parties of the first part, the rates of progress prescribed by the schedule hereunto appended have not been made, and it shall plainly appear to the governor and council that the parties of the first part are and will be unable to make such rates of progress, on the average, the governor and council, after giving to the parties of the first part three months' notice in writing of their intention to do so, may, if their default continues, put an end to this contract, and resume possession of the work, and of all the shops, dwelling-houses, buildings, machinery, tools, and all the property whatsoever belonging to the Commonwealth, which may have been delivered to the parties of the first part for use, under this agreement.

The engineer or engineers of the Commonwealth shall give the lines and grades of the Tunnel, and the lines of the central shaft, and be responsible therefor.

And for the purpose of determining the amount earned by the parties of the first part, from time to time, as the work proceeds, and for no other purpose, the following list of prices shall be taken as a basis of computation:—

#### EAST-END SECTION.

- 1st. For Tunnel enlargement, per cubic yard, *sixteen dollars*.
- 2d. For heading enlargement, per cubic yard, *nine dollars*.
- 3d. For extension of full-size Tunnel, per cubic yard, *eleven dollars*.
- 4th. For excavation and construction of central drain, with air

and water pipes complete, per linear foot of Tunnel, *thirteen dollars.*

5th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

#### CENTRAL SECTION.

1st. For constructing fire-proof floor over shaft, with self-closing iron hatches, *two thousand dollars.*

2d. For repair and completion of timbering to present depth of shaft, per foot in depth, *ten dollars.*

3d. For sinking shaft, per foot in depth, *three hundred and ninety-five dollars.*

4th. For two ten-inch iron pipes, set in place, per foot in depth of shaft, *six dollars.*

5th. For sinking sump below floor of Tunnel, per foot in depth, *three hundred and ninety-five dollars.*

6th. For excavating full-size section of Tunnel, per cubic yard, *fourteen dollars.*

7th. For excavation and construction of central drain, with air and water pipes complete, per linear foot of Tunnel, *thirteen dollars.*

8th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

#### WEST-END SECTION.

1st. For heading enlargement, per cubic yard, *nine  $\frac{75}{100}$  dollars.*

2d. For extending full-size Tunnel east, per cubic yard, *twelve dollars.*

3d. For arching part of Tunnel with bricks, per M of bricks laid, *twenty-two dollars.*

4th. For excavating and constructing central drain and laying pipes for supply of air for power and ventilation and water, per linear foot of Tunnel, *thirteen dollars.*

5th. For excavating central drain only, per linear foot of Tunnel, *four  $\frac{35}{100}$  dollars.*

6th. For constructing central drain west of west shaft, per linear foot, *three dollars.*

7th. For excavating for and constructing fifty linear feet of stone arch and filling over the same, *twenty-three thousand dollars.*

8th. For excavating for and constructing façade to the Tunnel and filling around the same, *twenty-six thousand dollars.*

9th. For clearing out and timbering the Haupt Tunnel and maintaining the same, *eight thousand five hundred dollars.*

10th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

And the engineer or engineers of the Commonwealth shall make a monthly measurement and computation of the amount of work done by the parties of the first part, which measurement and computation shall be conclusive upon the parties of the first part; and said engineer or engineers shall each month deliver a certificate in writing, with the statement of the amount in money which has been earned accordingly, to the governor and council.

And whereas it is provided by the statute of 1868, c. 333, that this contract shall contain satisfactory guaranties for the completion of the whole work herein contracted for, with limitations as to time and cost therein specified; and it is also provided by the statute of 1868, c. 350, that this contract shall provide for payments by instalments as the work progresses, in such manner that not less than twenty per centum of each amount due shall be reserved for a final payment on the completion of the same: Now, therefore, it is agreed that no sum whatever shall be demanded by or paid to the parties of the first part, under and in pursuance of this contract, until after they shall have earned, according to the certificates of the engineer or engineers, as above provided, approved by the governor and council, the full sum of five hundred thousand dollars; but twenty per cent. of each amount so certified by the engineer or engineers shall be reserved for the final payment on the completion of the whole work; and, for eighty per cent. of each amount so certified, certificates of the Commonwealth, under direction of the governor and council, and in form to be determined by the attorney-general, and approved by the governor and council, shall be issued to the parties of the first part, in sums of twenty thousand dollars each, setting forth the facts, bearing interest at the rate of five per cent. per annum from the time of issuing the same until the time of their redemption, and they shall be paid in Boston from time to time, in order of their issue, as often as it shall appear by the further certificates of the engineer or engineers, approved by the governor and council, that the parties of the first part have earned so much, that, after reserving twenty per cent. thereof, the Commonwealth will still retain, in all, the full sum of five hundred thousand dollars which is covered by said certificates of the engineer or engineers—it being the intention of the parties hereto that the Commonwealth shall make no payment which will at any time reduce its security from the reserved fund of twenty per cent. and from its guaranty fund aforesaid, below the sum of five hundred thousand dollars. And the Commonwealth shall, until the completion of the contract, reserve twenty per cent. of each amount due for work done, according to the certificates of the engineer or engineers, for a final payment, without any addition for interest, on the completion of the whole work



herein contracted for, and its acceptance by the governor and council; and subject to the above reservation and provisions, the Commonwealth shall pay to the parties of the first part, at Boston, on or before the fifteenth day of each month following the performance of the work, eighty per cent. of the amount of money earned by them, as ascertained and shown by the certificates of the engineer or engineers; and upon the final completion of the whole work herein contracted for, and its acceptance by the governor and council, and upon the surrender by the parties of the first part to the Commonwealth of all real and personal property of the Commonwealth which the Commonwealth will then be entitled to receive from them, under the terms of this contract, and in reasonable and proper condition and manner (reasonable use and wearing thereof, and loss or damage by fire or other unavoidable casualty excepted), and upon the adjustment of all questions growing out of this contract, and the execution and delivery by the parties of the first part of a release of all claims and demands upon the Commonwealth growing out of this contract, then the Commonwealth will pay to the parties of the first part such sum as may be necessary to make up the full amount of four million five hundred and ninety-four thousand two hundred and sixty-eight dollars; provided that no more than \$3,594,268 shall be paid until the final completion of said work.

STAMP.

In witness whereof the said parties of the first part have hereunto set their hands and seals, and the Governor of the Commonwealth and the Council have also subscribed these presents and caused the seal of the Commonwealth to be hereunto affixed, on the day and year first above mentioned.

W. SHANLY: [SEAL.]

F. SHANLY, [SEAL.]

By his Attorney, W. SHANLY.

ALEXANDER H. BULLOCK, *Governor.*

WILLIAM CLAFLIN, *Lt. Governor.*



THOS. TALBOT,  
JOHN S. BRAYTON,  
CHAS. ADAMS, JR.,  
HORATIO G. KNIGHT,  
CHAS. ENDICOTT,  
PETER HARVEY,  
R. G. USHER,  
A. K. P. WELCH,

} *Executive  
Councillors.*



## SCHEDULE.

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### DIMENSIONS OF THE TUNNEL.

In rock, without arch, 24 feet wide in the clear; 20 feet high in the clear.

Where arching is required, 26 feet wide in the clear;  $21\frac{1}{2}$  feet high above the rail when laid down.

A central drain to be constructed as required, with dimensions inside of masonry of not less than two feet square.

### THE WORK REQUIRED TO BE DONE AT THE HOOSAC TUNNEL UPON THE TROY AND GREENFIELD RAIL-ROAD.

#### I.—EAST END OF TUNNEL.

The work done consists of a Tunnel extending into the mountain from the east portal about 2,500 feet, a portion of which has been enlarged to the full height of 20 feet and the width of 24 feet, as proposed, and of a heading about 2,782 feet long, of which 1,700 has an average section of about 16 by 8 feet, and the remaining 1,082 feet a section of about 24 feet by 8 feet, making the distance penetrated from the east portal, 5,282 feet.

#### *The Work to be Done is—*

1st. Enlargement of the Tunnel to full size of Tunnel section required.

Estimated amount, 4,500 cubic yards.

2d. Enlargement of heading to full size of Tunnel section required.

Estimated amount, 28,000 cubic yards.

3d. Extension of full size section of Tunnel westward to meet workings to be brought eastward from central shaft.

Estimated length, 5,300 feet, making 85,100 cubic yards.

4th. Excavation below floor of Tunnel and construction of a central drain, as exhibited on the sectional drawing in engineer's office in North Adams, a copy of which is annexed hereto.

Estimated length, 5,600 feet.

5th. Provision and laying of the several permanent pipes in trench, as shown in drawing above described, for power, ventilation, and water supply, through a length of Tunnel.

Estimated to be 5,600 feet.

6th. Laying one track complete, including the furnishing iron rails, weighing not less than fifty-six pounds to the yard, chairs, spikes and cross-ties.

The Commonwealth shall permit the use by the contractors, without charge, for the purposes of the work herein specified, of the dam and canal, water-wheels, saw-mill, machine-shop, with its shafting, lathes, drills, benches and fixtures, compressors, and other machinery for power and ventilation, now set up and in use, with the buildings connected therewith, together with the pneumatic drills, air and water pipes, cross-ties, cars and drill-carriages, which are now in use for the prosecution of the work; stipulating that the contractors shall keep all the same, at all times, in a complete state of repair and efficiency.

The contractors shall hereafter make such repairs, renewals and additions, as shall appear to the officer in charge of the work necessary for durability or security, or for rapid prosecution of the work.

The Commonwealth will also hand over to the contractors all the tools of every description,—iron rails, steel, iron, powder, horses, mules, wagons, harnesses and other materials, now provided, which are available for the work, and the contractors shall take and pay for them at a valuation to be agreed upon by the parties to this contract, or in case of their disagreement or failure to act, the valuation shall be made by two competent persons, one of whom shall be selected by the governor and council, and the other by the contractors, the arbitrators to choose an umpire in case of disagreement; said valuation to be fixed upon before the commencement of work.

The Commonwealth will lease to the contractors, at a rent to be determined in the same way, the blacksmith's and other shops, with their fixtures for repairs of tools, cars, etc.

Such further buildings, machinery and material as may be needed for the work shall be provided by the contractors.

The material removed from the Tunnel at both ends thereof, will be deposited wherever the Commonwealth, by its officers in charge of the work, shall direct, it being understood that in case the contractors shall be required to deposit the same in embankment or spoil-bank on the east of the Deerfield River, they shall have the privilege of using the bridge to be erected by the Commonwealth under such reasonable restrictions as may be required; and the con-

tractors shall not be required to haul the same more than 3,000 feet from either end of the Tunnel.

The contractors shall, from and after the commencement of work under this contract, employ the necessary force of miners, laborers, etc., and shall maintain average rates of advance on each of the several sections, described as follows:—

1st. On the Tunnel enlargement, 75 feet per month.

2d. On heading enlargement, 75 feet per month.

3d. Extension of full size Tunnel, 125 feet per month.

4th. Excavation and construction of central drain, and laying pipes through the Tunnel, 150 feet per month, or not more than 500 feet behind the advanced heading.

The work of each separate section described shall be commenced at the west end of work completed by the State, and thence carried with a completed advance westward, reserving always to the contractors the privilege of working two or more breasts on each one of the sections described, in order to make up the aggregate progress required in each.

Temporary use of timber for covering central drain, as heretofore found convenient, will still be permitted, but permanent stone coverings must be provided and put in place, in advance of any allowance for track-laying.

Estimates will be made only of quantities within the exterior lines prescribed for the Tunnel.

Any material detached by blasting or otherwise outside of said lines must be removed by the contractors without charge.

## II.—CENTRAL SECTION.

The work already done consists in the sinking of 583 feet of the shaft, which is intended to have a total depth of about 1,030 feet to the floor of Tunnel, with such additional depth as may be deemed necessary for a sump.

The shaft is of an elliptical form, 27 feet in diameter on line of Tunnel by 15 feet transverse diameter, making an area of about 318 square feet, or  $11\frac{3}{4}$  cubic yards per foot of depth.

### *Work to be done is—*

1st. To construct over the shaft a fire-proof floor with self-closing iron hatches.

2d. To repair and complete timbering and finish excavation to present depth of shaft.

3d. To sink the shaft to floor of Tunnel.

4th. To set up two 10-inch iron pipes, for purposes of power and ventilation.

5th. To sink the sump below floor of Tunnel.

6th. To excavate a Tunnel east and west therefrom until it shall meet workings respectively from east end and west shaft.

7th. To construct the central drain, with air and water pipes complete, as shown on drawings exhibited at engineer's office, a copy of which is annexed hereto.

8th. Laying one track complete, including the furnishing iron rails, weighing not less than fifty-six pounds to the yard, chairs, spikes and cross-ties.

The contractors shall complete the shaft to the floor of the Tunnel by the first day of May, 1870.

They shall, before June 1, 1870, furnish and set in place the additional machinery, compressors, etc., requisite to maintain in the power-pipe a constant pressure of fifty pounds per square inch while supplying in each heading the continuous working of eight pneumatic drills, and also provide requisite air-pumps of power sufficient to furnish through the ventilation-pipe the proper air-supply for the ventilation of each of the headings.

They shall employ suitable force, and shall maintain, after June 1, 1870, an average rate of monthly progress of Tunnel excavated to full size, east and west, of not less than eighty feet in each direction.

All excavations from shaft or headings shall be deposited where directed by the engineer.

Price paid per linear foot of depth of shaft will include cost of sinking the shaft and removal of material to spoil-banks as shall be required, and of such additional timbering, frame-work, etc., as may be necessary for arrangement of pumps, hoisting apparatus and other machinery required.

The contractors will have the privilege of using, without charge, all the machinery designed for purposes of hoisting, pumping, ventilation, etc., already erected by the Commonwealth, and also the buildings over the shaft, the machine-shop, and machinery, water-pipes, drains, etc.

They shall constantly maintain the same in good condition by repairs and renewals, and return the same in good order at the expiration of their contract.

They will supply, at their own expense, the additional hoisting, pumping, ventilating and drilling machinery which may be required, excavate the spaces for, and furnish tanks, and also place ladders and other constructions and devices for escape and safety as required by the officers of the Commonwealth in charge of the work.

They may occupy and use the saw-mill, and blacksmith's and other shops erected by the Commonwealth, except such as may be



reserved by the officers of the Commonwealth in charge; shall keep the same constantly in complete repair, and pay therefor a rent, to be established in the same manner as is provided in the case of rents at the east end.

All horses, mules, wagons, tools, steel, iron and iron rails, powder, lumber and other materials provided by the Commonwealth, which are available for their work, shall be taken by them, at a valuation to be fixed upon before they shall commence the work, and to be ascertained, in case the parties do not agree, by arbitrators, chosen in same manner as provided for at east end.

### III.—WEST-END SECTION.

The work already done consists of a shaft 318 feet deep, having a section of 8 by 14 feet, from which headings have been extended about 1,609 feet east and westward to west end, and of a supplementary shaft 264 feet distant to the west therefrom and 277 feet deep, used only for purposes of pumping, and of an auxiliary shaft 685 feet farther to the west and 215 feet deep, through which the material of west heading may be hoisted until an opening can be made to west end.

From the present western end of the Tunnel, a distance of about 860 feet has been completed by B. N. Farren, contractor, who has existing contracts, upon which he is now engaged and under which he is to complete the Tunnel to a point 931 feet east of west end on or before the first day of June, 1869.

*The Work to be done under these Specifications consists in—*

1st. Enlargements of the headings already driven, and of the adit to the full size section of the Tunnel.

Estimated amount—52,800 cubic yards.

2d. Extension of a full size Tunnel eastward until it shall meet the workings in opposite direction from the central shaft.

3d. Arching part of the Tunnel with sound and hard-burned bricks,—amount of bricks to be laid not to exceed 4,500,000.

4th. Construction of the central drain, and in furnishing and laying the air and water pipes therein.

5th. Excavating for and constructing fifty linear feet of stone arch additional, and joined on to the present west end of brick arch, on such plan as may be furnished by the engineer or engineers, supported on foundations to be approved by the engineer or engineers, and properly filling over the same.

6th. Excavating for and constructing of granite a suitable façade to the Tunnel on such plan as may be furnished by the engineer or

engineers, to contain about 800 cubic yards, and properly filling around the same.

7th. Clearing out and securely timbering the Haupt Tunnel, so called, and maintaining the same until the completion of this contract.

The construction of the stone arch and the façade, being numbers 5 and 6 of the specifications for this section, is not to be commenced until the same is ordered by the governor and council.

8th. Furnishing and laying one track, including rails, chairs, spikes and cross-ties complete, according to specifications for track provided under head of General Stipulations.

The contractors shall employ suitable force, and shall maintain, after May 1st, 1869, an average rate eastward of monthly progress of Tunnel excavated to full size of not less than 100 feet.

The contractors will have the privilege of using, without charge, all the machinery designed for the purposes of hoisting, pumping, power and ventilation, etc., already erected by the Commonwealth, and also the buildings over the shaft, machine-shop, with the shafting, lathes, drills, benches and fixtures and machinery, cars, pneumatic drills and drill-carriages, water-pipes, drains, etc., stipulating that they shall keep the same at all times in a complete state of repair and efficiency.

The contractors hereafter shall make such repairs, renewals and additions as shall appear to the officers in charge of the work necessary for durability or security, or for rapid prosecution of the work.

The Commonwealth will also hand over to the contractors all the tools of every description,—steel, iron and iron rails, powder, horses, mules, wagons, harnesses, and other materials, now provided, available for the work; and they shall take and pay for them at a valuation to be fixed upon before they shall commence the work, and to be ascertained, in case the parties do not agree, by arbitrators chosen in the same manner as provided for at east end.

The Commonwealth will lease to the contractors, at a rent to be determined in the same way, the blacksmith's and other shops, with their fixtures, for repairs of tools, cars, etc.

Such further buildings, machinery and material as may be needed for the work shall be provided by the contractors.

Estimates will be based upon quantity of material which lies within the line of section prescribed by the engineer or engineers, and any material falling from outside of these lines, whether detached by blasts or falls, must be removed by the contractors without charge.

It being understood that where the engineer or engineers shall become satisfied that outside timber support is needed during the construction of the arch, he shall prescribe lines of section one foot outside of brick arch, as an allowance of space for timbering.

Dimensions and thickness of the successive portions of the brick arch will be prescribed by the officers of the Commonwealth in charge of the work, as the same progresses.

Price per cubic yard for excavation of Tunnel shall include all costs of temporary supports, pumping, drainage, power, ventilation and all material and labor and appliances requisite therefor, in addition to those which have already been provided,—and also cost of hauling and depositing the excavated material as the engineer shall direct.

Price per M for brick laid in arch shall include cost of timber for support, framing centres, labor, cement, sand, and all materials and labor requisite for making the arch complete.

Quality of brick, mode of mixing and using mortar, and quality and proportions of cement and sand shall be such as shall be prescribed and approved by the officers in charge of the work.

The contractors shall promptly remove and properly rebuild any work found bad or imperfect, or not in conformity with lines, grades and plans furnished.

All holes or vacancies outside of brick arch must be closely packed with stone of suitable size, by the contractors, without charge therefor.

All suitable bricks made at the State brick yard, during the present year, and not required by the Commonwealth or for Farren's contract, shall be supplied to the contractors and taken by them at \$9 per M, the same to be taken out of the amount due upon current monthly estimates.

The bricks are to be delivered at or near the yard, counted in piles, and thenceforward all loss or breakage in transportation or otherwise, to be borne by the contractors.

#### IV.—GENERAL STIPULATIONS

Applicable to each of the foregoing divisions of the work:—

The dwellings and storehouses of all kinds erected at the East End, Central Shaft and West End, except such as may be already disposed of or may be reserved by the officers of the Commonwealth in charge of the work, to be rented of the Commonwealth by the contractors, at the same rents as heretofore established, and the amount retained out of their monthly payments.

Measurements definitely establishing the present condition of the



Tunnel and other work shall be made before the contractors commence upon the same.

Monthly estimates to be made by the engineer or engineers of the amount and value of work done during the month preceding ; and at the completion of the work a final estimate shall be made by the engineer or engineers of the whole amount appearing to be due under this contract.

In case it shall appear at any time during the progress of the work that machinery provided at any point is not longer necessary there for the purposes of the work, then it shall be in the discretion of the officers in charge of the work to remove the same, if it be of the property provided by the State.

The work to be done under the direction and to the entire satisfaction of the Governor and Council as indicated through the officers in charge of the work.

The contractors shall use their best efforts to keep intoxicating liquors from their employés, and to promote orderly conduct among them ; and shall, when required by the engineer, discharge any men who shall be careless, negligent or incompetent, or guilty of conduct prejudicial to good order.

An employé once discharged for misconduct shall not be again employed upon the work without the consent of the engineer or engineers.

The prices heretofore named for rates of progress provide for all constructions, machinery, material and labor, etc., and for the cost of all accessory works requisite for the completion of the work described in these specifications, all of which shall be supplied by the contractors.

As a more rapid progress of the work is required than drilling by hand-labor would accomplish, upon each of the advance headings, between the East Portal and West Shaft, the contractors will be required to use the pneumatic drills, working continuously not less than 8 drills to a heading of 8 feet height, with not less than 50 lbs. air-pressure, but with the liberty to employ the form of machine now in use in the Tunnel, or any other drill of equal efficiency which they may prefer and provide at their own expense.

The contractors shall keep the completed portions of their work clear of all obstructions ; and shall, whenever required by the engineer or engineers, remove from the Tunnel and shaft all machinery, fixtures and material not needed for their work.

The track to be laid shall in all respects conform with the specifications in Farren's contract for the track of the Troy and Greenfield Railroad east of the Tunnel, and shall not be laid or paid for until the Tunnel is completed.



The parties of the first part shall, at their own cost and charge, cause the buildings and property of the Commonwealth which are allowed to the contractors without charge, to be insured against loss or damage by fire, in such reasonable amounts as shall be approved by the Governor and Council. The policies to be payable to the Commonwealth in case of loss. All moneys collected on such policies to be applied to the restoration of such property. But in no event is the Commonwealth to be further chargeable for such restoration.

It is understood and agreed, that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule, nor shall the specific details of work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part under contract to B. N. Farren, to be performed under this contract, nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract.

The foregoing schedule, contained in pages 6 to 12, is the schedule referred to in the body of the contract for the completion of the Hoosac Tunnel, executed this day, December 24, 1868.

ALEXANDER H. BULLOCK, *Governor.*  
W. SHANLY.

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COMMONWEALTH OF MASSACHUSETTS.

SECRETARY'S DEPARTMENT, BOSTON, December 24, 1868.

I hereby certify that the above is a true copy.

OLIVER WARNER, *Secretary.*

## CLOSING ARGUMENT OF HON. C. R. TRAIN,

FOR THE COMMONWEALTH.

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MR. CHAIRMAN AND GENTLEMEN :—

I appear at your request, and in obedience to the Resolve of the legislature requiring my attendance whenever the committees of the legislature desire it. I am free to say that, in aiding the Committee to obtain from the witnesses, and from reliable sources, all the evidence which may be necessary to enable them to pass upon any claim which comes before them, I feel entirely at home, and perhaps can afford the Committee useful assistance in the discharge of their very important duties ; but when it comes to the argument of a case like this, I confess I feel very much out of my element. I am in the habit, professionally, of addressing myself to claims which are either legal or equitable, as the case may be. In a court of law, we understand the question at issue between the parties, address ourselves upon the evidence to that issue, endeavor to apply the law as we understand it, and to obtain a decision upon the law and the fact, according to well-settled principles. In a court of equity, we undertake to accomplish the same thing ; that is to say, a man seeks in equity the enforcement of a right which he cannot enforce at law, because the rules of the common law are not applicable to it, or because the requisite parties to such controversy cannot be made parties to a suit at law, and in that mode we are familiar with the effort to obtain rights between man and man in the courts, both of law and of equity. A party has a claim which can be enforced either at law or in equity, and the rules applicable to the two tribunals and to the two modes of ascertaining and determining a man's rights are perfectly well understood. But there is no mode that I know of, either in law or in equity, by which one party

can enforce a gift from another party ; and, as it seems to me, these claimants come here substantially asking the legislature to make them a gift,—to make them a present in money,—I am free to say, I do not know exactly how to deal with such a proposition. It is very easy to give away another man's money. It is very easy to come and ask the legislature to do that justice to a party which he cannot obtain either at law or in equity ; and when a man comes with a claim which, but for the fact that the Commonwealth is a party, he could enforce in a court of law or equity, then I suppose it is the duty of this Committee, which sits here substantially as a court of claims, to apply the same rules to the trial of that claim as would be applied if you were sitting as a court of law or in equity. But that is not this case, as I shall undertake to demonstrate in a few moments. If a party comes before the legislature with an equitable claim,—I understand by that a claim which he can enforce in a court of equity,—you would apply the same rules to such a claim as the supreme court would apply if it was a case between party and party in that tribunal. But the claim set up here by these claimants is neither one nor the other. They do not pretend that they have any claim at law. They do not pretend that they have any claim in equity to which we can apply the ordinary rules of the equitable tribunals of the Commonwealth, and therefore I say they come here asking you substantially to make them a present. And that is where my difficulty arises. I do not know how to argue the question to a committee of intelligent gentlemen, whether they ought to recommend the legislature to put its hand into the treasury of the Commonwealth, and out of that treasury to take thousands and thousands of dollars, more or less, and put them into the pockets of these claimants. Such a proposition as that is influenced by considerations with which I am not familiar, except as applicable to my own property. If a man asks me to give him my own money, I understand what that means. I can give it or let it alone, as I please. If he asks me to give him my neighbor's money, then he makes a request of me in a form in which he has no right to make it, and I should hesitate long before I undertook to accede to it, if I had the power. Now, I have said

that the Messrs. Shanly ought to plant themselves upon one of two propositions before they ask for a report in their favor,—either that they have a legal claim, which they cannot pursue at law, or that they have an equitable claim, which they cannot pursue in a court of equity; and if they do not present themselves here with such a claim as that, I submit that they ought to be dismissed; that the report of the Committee should be, that the claimants have leave to withdraw.

Let me dwell upon this for a moment. There is a class of claims which the legislature deal with constantly, and all legislatures must deal with, and the Congress of the United States deals with them, through the court of claims, established for that purpose. A man has a legal claim, but he cannot sue the Commonwealth. Very well. Then he comes to the legislature, and the legislature either consider that claim, and settle it, or they pass a Resolve authorizing him to go into the courts, or create a tribunal—a commission—for the purpose, and have it settled; and if the Messrs. Shanly have such a claim as that, the proper way, in a case like this, in my judgment, is for you to recommend the legislature to provide a way for them to go into the courts, and let the courts settle any claim that they have. If they have an equitable claim, which they can enforce in a court of equity, give them the same facilities, that they may go there and settle it. That is the mode in which claims like this, as I understand, should be dealt with. It is an equitable mode; it is a legal mode; and they are remitted to the same tribunal to which they would be remitted if it was a controversy between individuals, and it is the highest justice which the legislature should accord to them. There is another class of claims. A man receives an injury while in the service of the Commonwealth, as an employé of the Commonwealth. He is a member of the volunteer militia, and has an arm blown off at a muster, or he receives some injury while in the performance of a public duty. He comes to the legislature, and they compensate him by a pension, or by an appropriation in some form, and that satisfies that claim. That is a claim that cannot go into the courts, as far as I know. There is another kind of claim, of which you have had illustrations here this winter, and are having them constantly, where a municipality



is entitled to expenses incurred, provided they perform certain duties, make certain returns, in accordance with the provisions of the statute. For some reason or other, they have omitted to comply with the statute, and they come in and ask you to relieve them from the burden of losing that money, because of an omission which was accidental or unintentional, and where the State has received no detriment.

These are all proper claims to be adjusted by the legislature. But claims which arise out of contracts between an individual and the Commonwealth, and which would be enforceable in the courts but for the fact that the Commonwealth is a party, stand upon an entirely different principle, I apprehend, from the ordinary legislation which is asked at your hands; and unless the party brings himself within the rules which would be applicable to such controversies, he simply comes here and asks for a gift,—he asks for a present. That is the position in which I find these claimants to-day, and that is what embarrasses me in the discussion of this question; and so far as I feel at liberty to say anything in regard to it, I shall take the liberty to say, as I do now, and may repeat hereafter, that the legislature has no right to make a gift of money to an individual out of the public treasury; that its charities are not to be bestowed in that mode; that a contracting party with the Commonwealth is entitled to his rights, and ought to be dealt with by the Commonwealth exactly as he would be dealt with if he had contracted with any other party, and could have his remedy in the courts of the Commonwealth; and beyond that the legislature has no right to go, any more than I have a right to put my hand into your pocket, Mr. Chairman, and out of it abstract your money and give it to my friend upon the other side.

Now, with these introductory remarks, let us see if we can draw from the situation of these claimants towards the Commonwealth any other proposition than that they come here asking us to do them a charity. I submit, that the history of this whole contract, from the legislation upon which it is based down to now, substantiates my proposition. First, I want to call your attention to chapter 333 of the Acts of 1868, under which this controversy arises. By that Act, the governor and council were authorized to make the contract which

was subsequently made with the Messrs. Shanly. They were authorized to contract for the whole work of constructing the Hoosac Tunnel: "*provided*, that a contract with satisfactory guarantees, can be made for the completion of the same within a period of seven years at a cost not exceeding five millions of dollars." Now, the governor and council were not authorized by that Act to make a contract for anything less than the completion of the Hoosac Tunnel. They were authorized to make a contract, if they could, which should complete that Tunnel, ready for public use, provided they could do it within the sum of \$5,000,000, and with an obligation that it should be completed within seven years. That was all the power which they had. I need not advert to the history of the Tunnel. Everybody is familiar with it. It had been bandied up and down the Commonwealth for more than twenty years when that statute was passed, and for the purpose of bringing it to a completion, if it could be done, the legislature of 1868 passed that Act.

Now, what was done by the Executive of the Commonwealth under that Act? In the first place, as you remember, as soon as the proper specifications could be prepared, and the proper advertisement, the Act having been approved on the ninth day of June, 1868, sometime in July or August, Mr. Endicott tells you these proposals were issued, advertisements were published in this country and in Europe, and bids were received by the governor and council for a contract. Those proposals called for bids *upon items*, as set forth in the specifications. The Messrs. Shanly were gentlemen well known to the eminent engineers of the country as contractors and engineers of great ability. Certainly it is a compliment to those gentlemen that Mr. Latrobe (perhaps there was no man more distinguished in his profession at that time than Mr. Latrobe) should have personally called their attention to this enterprise. It showed his estimation of the ability of these gentlemen, both as engineers and contractors. At any rate, without that invitation, I have no doubt these gentlemen had their eyes upon the Hoosac Tunnel, for Mr. Shanly tells you that he had kept himself posted in regard to it from the commencement of the enterprise down to the time he came here to make the contract. He knew all about it, or as much

as anybody did, and he and his brother came and made their proposition, under the advertisement which had been put forward by the governor and council. These suggestions which I am making bear upon the question of whether Mr. Shanly or his brother were entrapped into anything improperly by the agents of the Commonwealth. They came here, and Mr. Shanly says he was familiar with the character of the rock, with the character of the Tunnel, and with the extent of the work. He had read Prof. Hitchcock's report upon the character of the Tunnel, and he had all the information he wanted. He had all the information that could be obtained, except the information which was to be derived by the actual perforation of the Hoosac Mountain, in the process of creating this Tunnel. The Messrs. Shanly acted as intelligently as any of the other contractors who put in their bids; probably more so, because I judge, from the fact that their attention was subsequently recalled to it by the governor and council, that they had impressed themselves upon the authorities of the Commonwealth as the most intelligent and the best competent to carry forward this enterprise of all the men who had put in their bids for the contract. They made their bids, and their bids were accepted. One by one the other bidders were wiped out, and it came to the Shanlys. There was a requirement that half a million dollars in securities should be put up for the faithful execution of the contract. On the 16th of October, if I remember the date correctly, the Messrs. Shanly, finding that they could not comply with that requirement on the part of the Executive, addressed a letter to the secretary of the Commonwealth, withdrawing from the competition. In a very polite note, which you will remember, finding themselves unable to put up the requisite security, they thanked the governor and council for their courtesy, and withdrew; perhaps intimating (I do not recollect exactly about that), that if any other phase of the matter should occur, they would be happy to be consulted further.

That ended all the efforts of the executive department to have such a contract made. They had endeavored to frame such a contract, and, for some reason or other, they had failed. They were acting under the advice of my very excellent and learned friend who now appears for the Shanlys, and when



the thing came up again, I have no doubt that Mr. Allen advised the state authorities, or he had advised them before, at some time, that such a contract as they had advertised for ought not to be made ; that they had no power to make such a contract ; and that if they made a contract, they must make an *entire contract* for the completion of the whole work, according to the provisions and under the provisos of the Act of 1868 ; and so, when the Messrs. Shanly are sent for again, they are told that that is the kind of contract they must make ; that the governor and council cannot run the risk of entering into a contract which shall look to the completion of the Hoosac Tunnel *not* within the \$5,000,000. They have got \$5,000,000 to spend in completing that Tunnel. If they make an entire contract within that sum, and hold the contractors to their contract, it will be accomplished within the meaning of that Act. If they make an item contract, it may or may not come within the \$5,000,000. It may exceed that amount, and if it does, then they have made a contract which they have no right to make, and they must know at the start, that that Tunnel is to be completely finished, ready for public use within the contract, before the governor and council can sign it. Well, the only change that was necessary for anybody to make was to ascertain what security, to begin with, the Commonwealth required for the performance of the contract. The Commonwealth said, "Instead of requiring you to put up \$500,000, in United States bonds or securities, we will allow you to work until your earnings have accumulated to \$500,000, before we will pay anything. That will be security enough so far. Then we will put in a provision that you shall be paid according to your monthly estimates, and 20 per cent. shall be reserved under the further provision of the contract" (to which I now wish to call your attention), "that in case a contract shall be made by the governor and council for the completion of the Tunnel, there shall be withheld from the payment under said contract, a sum not less than \$1,000,000, until the final completion of said work, and the acceptance of the same by the governor and council." That was satisfactory to the other side. They were content with that. Then nothing remained but for them to ascertain



the gross sum for which they were willing to take the contract, and they took the contract for the gross sum of \$4,594,268.

Now, we have got intelligent men,—not simply contractors, who excavate rock and earth and dump it where engineers tell them,—but we have got accomplished engineers, accomplished railroad engineers, and accomplished mining engineers. We have got men familiar with the character of the work upon which they propose to enter, and they have the benefit, not only of their own knowledge, their own experience, and their own skill, but they have the benefit of the skill of the engineers who have been employed by the Commonwealth for a period of fifteen or twenty years, and they relied upon them, and had a right to rely upon them, as they would rely, and as you and I would rely, upon any competent men to ascertain a given state of facts, about which we desired knowledge. Now, with those means and sources of information, they make this contract. They “covenant and agree with the Commonwealth to do and perform all the work necessary to complete the Hoosac Tunnel in accordance with the schedule hereunto appended, to lay down and complete through the whole length of the Tunnel one railroad track, and after the completion of the Tunnel and railroad track, to remove from the Tunnel all materials and other things, so as to leave the Tunnel and railroad track in complete order, ready for use, to the satisfaction of the governor and council of the Commonwealth.” That is what they undertake to do. “In accordance with the schedule hereunto appended”; the “schedule hereunto appended” being a schedule of the work already done, and the work required to be done. The object of that schedule will appear more especially directly. “The size and general description of the work; the estimated amount of the same; regulations governing the manner of its performance; the rates of progress required in its prosecution, and various general and particular stipulations and provisions affecting and binding both parties hereto are set forth in the schedule hereunto appended which constitute a part of this agreement. *But no errors in the estimates of the work to be done, and materials to be furnished under this contract, shall affect the contract price to be paid for the whole work.*” Now, the Messrs. Shanly have made a contract with the Commonwealth by

which they are to receive the contract price, \$4,594,268, whether there are any errors in the estimates of the work to be done and materials to be furnished under this contract or not. That is a stipulation for their benefit, and goes to show that the items and schedule and estimates were not to enter into any settlement between these parties, but they were to receive a gross sum. Now, if you will turn over to page 12, you will find a corresponding clause in the contract for the benefit of the Commonwealth. The one I have just read is for the benefit of the contractors. "It is understood and agreed that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities; distances, etc., given in this schedule, nor shall the specific details of work to be done as given herein be construed in any manner *to relieve the contractors from the full and complete performance of the entire work and completion of the Hoosac Tunnel*, exclusive of the part now under contract to B. N. Farren, *nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract.*"

Mr. ALLEN. You have skipped the important words, "exclusive of the part now under contract to B. N. Farren, *to be performed under this contract.*"

Mr. TRAIN. That does not refer to the part under contract to Farren.

Mr. ALLEN. I do not claim that it does, but I consider that clause, "to be performed under this contract," very important.

Mr. TRAIN. I do not. It does not affect it one particle; there is where you and I have always been at issue ever since you got on that side of this case. But when this contract was drawn, Mr. Shanly tells us himself, that he understood he was to do this whole work. He never understood anything else. The Commonwealth undertook by its officers,—faithful, vigilant, and learned men,—to make such a contract. Now, the Shanlys undertake to say that that contract is limited and controlled by the schedule. I say it is not. I say, if it is, that is a question of law, and I offered last year, before the committee on the Hoosac Tunnel, to let them go before the supreme court and have a construction put upon that clause of the contract, and they would not go; they did not want

any such adjudication as that; they would rather have the law settled by the legislature than by the highest legal tribunal. I say that it is too late now for these gentlemen to claim that they made an *item contract*, when they say that they intended to make an *entire contract*; that both sides so understood it; that such a contract was the only contract which the legislature had authorized the Executive to make; that an item contract had been expressly abandoned, and Mr. Shanly was told when he came here in November or December, that it must be a contract for a gross sum, and for the whole work.

Let us apply a little word-criticism, because Mr. Allen will do the same thing when he comes to his argument. "It is understood and agreed that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule, nor shall the specific details of work to be done as given herein be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part now under contract to B. N. Farren, to be performed under this contract." Well, the contract is the paper signed by the governor and council contained on pages 1, 2, 3, and 4, and the schedules are appended for the purpose of showing how the monthly estimates shall be obtained, how the contractors shall be paid, and, generally, what work there is to be done; but nobody but my learned friend on the other side, no layman, certainly, would undertake to say that if they had made a contract for the completion of the entire work of building the Hoosac Tunnel, they subsequently, without authority, undertook to limit it by the operation of these schedules. If that was Brother Allen's idea in making this contract, he was more of a bungler than I ever supposed him to be.

Now, you have to take this contract and apply it to the items for which they now come and make a claim, and the first item in their claim is for "enlarging Tunnel first 800 feet from east portal." Well, all I need to do in that behalf has been already done by the governor and council in passing upon the claim which the Shanlys submitted in December last. What the governor and council claimed then, what I claim now, and what I claimed last year in relation to the



arching, was, that this was an entire contract, and that these contractors were bound to do whatever was necessary in order to make the Tunnel safe for public use; and that although the schedule on the sixth page speaks of work already done, the Commonwealth are not bound by it. It might be more, and it might be less. The contractors took the work as it was, for the purpose of completing the whole work under the statute of 1868, and all these suggestions that I have made in reference to the contract, that it was not an item contract, that that was abandoned, and that they subsequently came back and entered into an entire contract, apply to that item in the claim.

The second item is for "grading embankment at east end." That claim appears before you in the paper which I submitted of the settlement with the council as \$4,111.18. The Shanlys were allowed \$600, which was for work done under the administration of Mr. Field, who had died, and for aught I know, the Shanly's concurred in that allowance as applicable to that work as being correct, and I never heard of their objecting to it; but they claimed for the whole work which they had performed upon this embankment. The governor and council disposed of it in the same mode as item 1, as being within the terms of the contract. That portion of the contract applicable to that claim is on page 7: "The material removed from the Tunnel at both ends thereof, will be deposited wherever the Commonwealth, by its officers in charge of the work, shall direct, it being understood, that, in case the contractors shall be required to deposit the same in embankment or spoil-bank on the east of the Deerfield River, they shall have the privilege of using the bridge to be erected by the Commonwealth, under such reasonable restrictions as may be required; and the contractors shall not be required to haul the same more than 3,000 feet from either end of the Tunnel." Now, the engineers tell you that it is the duty of these contractors to deposit that material within the limit of 3,000 feet, as the engineers shall direct them; they tell you that it is the duty of the contractors, under those circumstances, to adhere to the grade, not to fill higher than the grade which is fixed by the engineers; they tell you that the parties who were employed by these claimants to do



this work persisted, in spite of instructions (Mr. Philbrick tells you that, as well as Mr. Frost), in filling higher than the grade; and so far as that shall be found to be the fact, then these contractors, when they were restoring that material to grade, were simply performing a duty which they might as well have performed at the outset, and for which they certainly have no right to make a claim. But I think, in fairness, I ought to allude to the fact, that Mr. Frost now tells us that there is some money due the Shanlys for work performed, which is included, as he supposes, in this claim, but which he expected would be paid for through his office, and which he is ready to pay through his office. How much it is, I do not know; I suppose he will let us know, and give us some other tables in connection with these matters. The Messrs. Shanly, claiming for the whole of it, take mighty good care that we shall not know how much that work is. That might be a legal and proper claim against the Commonwealth. I suppose they may know as well as Mr. Frost, but Mr. W. Shanly won't tell us; he does not give us any enlightenment upon it. He wants the whole. It is perfectly clear that, under this contract, he is not entitled to the whole; and when he asks for a part, you will simply hold him, as you would if you were sitting as a jury in a court of law, to prove the amount of his claim. That is all I desire. I will endeavor, as far as I can, through Mr. Frost, to get that portion which Mr. Frost says he should pay him in any event, and which he says he had not ascertained before, because the Shanlys were claiming for the whole of that grading. I think it is perfectly clear, upon the construction of the contract and the testimony of the engineers, that they ought not to be allowed for reducing that filling to grade; that they filled above grade in their own wrong, and that the Commonwealth is not to be chargeable for it, any more than if the contract had been made with either of you gentlemen.

Item 3 is for "making central drain 5,017 feet from east portal." That item, if my construction of the contract is the true one, stands exactly as does item 1. They took the contract, and they took all the risks. They did not choose to uncover the central drain and examine it. If they had chosen to, they would have discovered, what was subsequently discovered, to

wit, that that drain was not made at grade, as the engineers supposed, as Mr. Shanly supposed, and everybody else supposed. There is no doubt that everybody supposed that that central drain was down to grade; but Mr. Shanly took this contract subject to that infirmity, as he did in reference to everything else that was to be done in relation to it.

Item 4 is for "increased working expenses because of destruction of Haupt Tunnel." Now, in relation to that, the Committee will see that they were paid \$8,500 for clearing out, maintaining and timbering this Tunnel, as appears on page 10 of the contract, "clearing out and securely timbering the Haupt Tunnel, so called, and maintaining the same until the completion of this contract." Now, under that, the Shanlys claim that they were entitled to the use of this Tunnel until the completion of the contract. They claim that they had completed the contract in September, 1874; that we had broken down the Haupt Tunnel in the winter of 1874; and that they are entitled to recover of the Commonwealth the damages to which they were subject by not having the use of the Haupt Tunnel through which to discharge the debris that they were taking out of the west section. That is their claim. Well, they cleared it out, they timbered it, and maintained it, and for that they received \$8,500, and I think it is fair to concede that they had a right to its use until their contract had expired. The governor and council, as you will see by their report, declined to pass upon that item, because the Shanlys said, "It is no matter what you give us here; we shall settle with you, but we are going to the legislature to get some claims, which we think are equitable, allowed us"; and so the governor and council said, "Very well, if you are going to the legislature, we won't consider that. You may have some equitable claim there. You may be entitled to some consideration, but that whole claim may be passed upon by the legislature." Now, it appears that we broke down the Haupt Tunnel in January or February, 1874. I am not quite sure that I am right about the time, but it was before the month of March, when the contract, by its terms, expired.

Mr. ALLEN. The first interference with the Haupt Tunnel was in August, 1873, the next was in February, 1874.

Mr. TRAIN. What was there in 1873? I have forgotten that.

Mr. ALLEN. They made a blast so near that it shook down a great quantity of debris. It was the subject of correspondence between Mr. Frost and Mr. Shanly, which has been put in.

Mr. TRAIN. Has it been read?

Mr. ALLEN. Yes, sir.

Mr. TRAIN. Well, whatever there was in 1873, had passed out of my mind in the multiplicity of things which I have had to consider since this hearing began. Whatever interruption there was in August, 1873, has been shown, or can be shown, and if the Shanlys are entitled to anything for that, I suppose the Committee, as fair-minded men, will report it, if they decide that this is the proper mode in which the Shanlys should settle with the Commonwealth, under this contract. And the same remark is true with regard to the final interruption, when we broke down the Haupt Tunnel for the purpose of building the track to take its place. The only difficulty which embarrasses my mind in relation to it is in ascertaining what that was. The Shanlys were bound to have completed that contract in March, 1874; that was the term of the contract, and there is no earthly doubt that they might have completed that contract by the first of March, 1874, if they had used the proper foresight and precautions, and had the capital which was necessary for men who undertook to perform such a contract as that. I say that upon the testimony of Mr. Philbrick, and upon the testimony of everybody else, except Mr. Shanly himself. Mr. Philbrick tells you, in so many words, and the result demonstrated it, that the delay in the execution of that contract within its terms, grew out of two things: *first*, the fear of Mr. Shanly that he should meet with more water than was subsequently developed in the west section; and *second*, the improvidence of not providing suitable pumping apparatus. I rely in that statement upon the testimony of Mr. Philbrick. I believe Mr. Philbrick; he is an intelligent man, an accomplished man in his profession. I have heard no suggestion against him. He is not open to the criticism which my friend may make upon Mr. Frost. It is perfectly clear to my own mind, upon tak-



ing the testimony of Mr. Philbrick, as I did last night, and reading it carefully through from the report of Mr. Yerrinton, that Mr. Philbrick was entirely right in keeping the Executive posted as to the obligation of these contractors under their contract, and as to what they might do with proper apparatus in keeping the water out of the central shaft; and that Mr. Shanly, for his own purposes, to save his money, or for want of proper foresight, did not provide the requisite apparatus in order to meet an exigency which he thought might arise, but which never did arise as a matter of fact, because there was no time, according to Mr. Philbrick's testimony, when, if he had contemplated what was contemplated by the Commonwealth when they started upon the enterprise of building that Tunnel, and which is contemplated by the contract itself,—there never was a time when he ought not to have been ready with his plans, so that in sixty or ninety days, according to the testimony of Mr. Philbrick, he could have put in the requisite pumping apparatus to keep that work free, so that he could have worked on all four faces at once; and if he had, it is perfectly certain, not only that the contract would have been performed within its time, but that the complaint which Mr. Shanly now makes, that too much money was kept back in the treasury, it would not have been in his power to make, because he would have received his \$14 a yard, which he was entitled to receive for all work on the east and west faces developed from the central shaft.

Mr. PRATT. There is one portion of your argument I do not quite understand. You mentioned that the governor and council allowed them on this Haupt Tunnel \$8,000.

Mr. TRAIN. No, sir; he has been paid that for cleaning out and timbering the Haupt Tunnel under the contract.

Mr. PRATT. This \$2,700, is in addition to that?

Mr. TRAIN. Yes, sir.

Mr. PRATT. I thought you said that the governor and council said, inasmuch as he was going before the legislature, they would not pay him anything.

Mr. TRAIN. You partly understand me and partly do not. He received \$8,500 for clearing out and timbering and maintaining the Haupt Tunnel, under this provision of the contract, which you will find on page 10, "Clearing out



and securely timbering Haupt Tunnel, so called, and maintaining the same until the completion of this contract." They received, as I understand it, \$8,500 for doing that. Now, when they get through with the job they say, "We were entitled to the use of the Haupt Tunnel until the completion of the contract, but you broke it down so that we could not use it for the last few months of our job, and were put to great expense in getting out our material by hoisting it through the shaft, and by other modes which were more inconvenient and more expensive than if we had been allowed to take it out on the track through the Haupt Tunnel."

Mr. PRATT. That is a claim for being deprived of the use of it?

Mr. TRAIN. Yes, sir, and as Mr. Shanly said he was coming to the legislature, the governor and council said possibly he might be entitled to something for the interruption, and he must take the whole claim to the legislature; they would not undertake to settle it.

Now, if I understand the matter, Mr. Allen will claim, not only that they are to be paid for the interruption prior to the first day of March, 1874, which is the time when this contract in terms is to be settled—about six weeks—but that they are to be paid for the interruption during the whole summer, until the job was finally done. Well, there is a provision on the second page of the contract that the governor and council may extend this contract: "*provided, however, that in no case shall the completion of the whole work be delayed more than six months after the first day of March, A. D. 1874.*" Now, he claims, it seems to me, a little more than anybody would get allowed in any court of justice that I ever heard of. He was bound to finish that job by the first day of March, 1874. We say he ought to have got it done by the first day of March, 1874, and that we have a claim against him for not getting it done on the first day of March, 1874; but he turns round and says, "Why, you extended the time to September, 1874, six months, and now, inasmuch as I did not get my job done by the first of March, and you were kind enough to extend it six months under the provisions of the contract, I want to be paid the damages that I suffered

during those six months." Well, where is the law or equity of that proposition?

Mr. MOSELEY. You did not state the reason why that extension was made. I would like to have you.

Mr. TRAIN. I do not know what he said to the council. He had not got it done, and the governor and council never said anything about it. There is no record of any extension.

Mr. MOSELEY. I understood from the evidence, as far as I heard it, that it was on account of the Lord's sending a deluge up there.

Mr. TRAIN. Well, it is perfectly clear that the Lord's deluge did not stop him. He had said that if he could have had his own way he would have got it done, as it was, before the 1st of March, 1874. Mr. Shanly insists, and for aught I know he is right, it does not affect the question under discussion here, that if he could have been allowed, and he was pretty much allowed; nobody could handle him any more than you could handle a mule, I guess, except where money was concerned—he insists that if he could have had his own way, he would have got through with the Tunnel months before the 1st of March, 1874. I only allude to that because it does not lie in his mouth to say that they did not get through in March, 1874, on account of the storm. He puts it on account of the water. At any rate, he did not get through. I claim he might have got through, upon the testimony of Mr. Philbrick, but he did not get through; and now, assuming for the moment that we have extended the contract for his benefit, he insists that we extended our liability to him at the same time. What kind of a way is that? I hold your note, and you come to me and say, "Mr. Train, I can't pay that note on the day it is due; I want you to extend it," and I do extend it. Do I put myself in your power in any way except that you are at liberty to pay that note at the date to which its payment was extended? He says that we extended that contract, with all the liabilities on both sides. I say, "No." The governor and council sat quietly still, and let him work away. They did not tell him whether they extended the contract or not.

Mr. ALLEN. I beg pardon. The testimony is the other way.

Mr. TRAIN. There is no record of the extension.

Mr. ALLEN. The testimony is that Mr. Shanly made his application, and after a full hearing before the council, and in the presence of the members of the council, the governor told him that he could have his extension, and asked him if he wished to have it in writing, and Mr. Shanly replied, "This being done in the presence of the council, I am satisfied."

Mr. TRAIN. I never understood it so, but I am content to take it so. I know there was a reason why there was never any vote of the governor and council in relation to the extension of that contract, but it does not affect my argument in the slightest degree. Mr. Shanly carried a memorial to the governor and council, asking, for reasons set forth in that memorial, among others the delay occasioned by the great storm, that that contract might be extended. Now, assuming Mr. Shanly's statement to be true, and that it was extended, what I claim is *that they extended the time in which Mr. Shanly might perform the work which he was obligated to perform, but that it did not extend any liability of the Commonwealth to him.* Does anybody suppose that the governor and council, or anybody else, in giving time to a man who has entered into a contract to perform certain work, thereby extend their own liabilities growing out of that contract?

Mr. ALLEN. Mr. Attorney-General, if there is the least question about the fact, I wish you would have the kindness to address a note to Governor Washburn.

Mr. TRAIN. I am entirely content to have it as you say.

Mr. ALLEN. There is no question about it.

Mr. TRAIN. I am entirely content to have it that they did orally agree to extend the time; it does not change it, in my judgment, in the slightest degree. What did they extend to Mr. Shanly? We will see what he asked, to begin with. Here is his memorial. Certainly he will not object to my reading that.

*"To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.*

"The contractors for the Hoosac Tunnel respectfully represent:

"That the earliest period fixed by the contract for the completion



of their work—namely, 1st March, 1874—is at hand, and that they cannot fully complete their undertaking by that day.

“That the contract further provides, that if unexpected difficulties should arise, making it impossible to preserve the prescribed rates of progress west of the central shaft, the governor and council may grant to the contractors an extension of time, not to exceed six months; in other words, may enlarge the time for completion to 1st September, 1874.

“The contractors claim that a most unexpected and serious difficulty did occur west of the central shaft, in the change of formation to wet granite from dry mica-slate,—geologists, engineers, contractors and others having always assumed that the latter class of rock would be found to prevail from the east end right through to the western slope of the mountain.

“The immense quantity of water found in the granite rendered it impossible to prosecute the heading west of the central shaft until, in December, 1872, a junction of headings to the eastward had been effected, thus allowing of the water being disposed of without the delays and enormous expense of lifting it through the shaft.

“Owing to the above cause, some eighteen months of time in driving the heading west of the shaft was lost to the contractors, besides, in the matter of pumping, involving them in a ruinous outlay.

“The contractors further represent that the stone arch and façade at west portal cannot be completed by 1st March, the plans for the same having only been furnished them in October last, and the recent destruction, by the operation of the McClellan contract, of part of the Haupt Tunnel, through which convenient access is alone to be had to the works at the portal, must cause still further delay there.

“They would also recall to the recollection of His Excellency and council, that some weeks were lost in the west-end workings, in October, 1869, by reason of the great rain-storm of the 4th of that month, a difficulty certainly of a most unexpected character.

“The contractors therefore ask that His Excellency and the honorable council will be pleased to order that the time for completing the contract for the Hoosac Tunnel be extended to the 1st September next.”

Now, the most that my friend can claim upon the other side, is, *that the time was extended*; but he claims that we are chargeable with damages because of the loss of the use of that Tunnel during the extended time. I say that that is a claim that could not be maintained in any court of justice in



this Commonwealth, or any other; and if he could not, it ought not to be allowed here. But there is another thing in relation to this claim, aside from the uncertainty of it, and aside from the claim that I make, that he is to be limited to the 1st of March, 1874. There were months when, according to the testimony of Mr. Philbrick, and Mr. Shanly himself,—he is perfectly fair and ingenuous about it,—that Haupt Tunnel might have been used by the contractors for the purpose of delivering the debris out of the west section of the Tunnel, when it lay perfectly idle. He would let that Tunnel lie idle until such time as he chose to use it, and then, when it has become necessary for us to break it down, for the purpose of extending the road, he turns round and says, "True, I might have used that Tunnel within the time limited in the contract, but I did not choose to; and now, when the time in which the contract is to be executed has expired, I cannot use it, and you must pay me damages." I submit, that if there is any ground on which the Shanlys could claim anything in the tribunals of the Commonwealth under that item, it is to be limited to any damage which accrued before the 1st of March, and is to be controlled by the fact that there were months before that time when they might have used it and did not use it.

Now, passing from that item, we come to item 5: "Taking down loose rock after Tunnel had been trimmed." My answer to that is the same answer which was made by the governor and council to the claim, and which is supported by the testimony of the engineers: that it is within the contract. They were bound by the terms of this contract to make this Tunnel "so as to leave the Tunnel and railroad track in complete order, ready for use, and to the satisfaction of the governor and council of the Commonwealth." A Tunnel for public use, over which trains are to be run, which is not safe by reason of loose rock remaining in the roof, is not such a Tunnel as is required by that contract; and they were required to take down that loose rock, for the purpose of making it safe, and that was all they were required to do. They have been required to do that to the extent which the contract authorized, but, if I understand the testimony of Mr. Philbrick and Mr. Frost, they have not accomplished that; even with what they

have done, it is not safe to-day. Not only the portions of the Tunnel that are required to be arched were not arched by them, but the portions of the Tunnel over which they went they have not left in safe condition, for reasons which were satisfactorily explained to you by Mr. Philbrick. They put on men, and wasted, I do not know how many dollars, but a great many dollars, by putting on men who either meant to slight the work, or did not know how to do it properly, and had to be educated up to the proper mode of doing the work. At any rate, Mr. Philbrick tells you that he told the governor and council, and that the fact is, that it will cost anywhere from \$10,000 to \$20,000 to make that Tunnel safe, and that was within the terms of their contract. Yet they come here and ask you to pay them for their omissions. They should pay us \$10,000 or \$20,000, whatever it may cost us, to trim that Tunnel; they ought to pay us. If they come with equities on their side, they must do equity. That is the rule.

Item 6 is "for clearing out the Farren arch," and that is within their contract, unless we filled it up. It was filled up by the storm of October, 1869. They cleared it out to some extent, but not entirely, leaving what they chose in the bottom of the Farren arch, and subsequently they cleared it out, and now they charge us for it. Well, that is one of the things required by the contract, because, as you will see, they were to lay the track through this Tunnel, including the Farren arch. They were not at liberty to lay their track to the west shaft; they had got to lay the track through this entire work, when it was done. That included the Farren arch. Now, they could not lay the track unless they removed that debris out of the Farren arch, and it became part of the duty to which they were obligated to clear it out so that they might lay that track. Well, they cleared it out, and subsequently the legislature authorized the governor and council to settle with them, so that they need not lay that track, and there was an allowance made because they were relieved from that part of the contract; but it did not relieve them from the obligation to clear out the Farren arch, so that *we* could lay the track. It comes, as I claim, directly within the terms of the contract; and they admit, with regard to this item, as they do in regard to all these

items, that, as matter of law, they have no claim. Their receipt, given to the governor and council upon their settlement, would be a sufficient answer to all these claims, if it were possible to raise a legal proposition by which a legal liability could be sprung upon the Commonwealth by an individual dealing with the Commonwealth as a party answerable in the courts. They came to the governor and council, and the governor and council settled with them. They gave their receipt and went away, and Mr. Shanly frankly tells you that, as a matter of law, they have no claim.

Mr. ALLEN. Are you not stating that rather strongly ?

Mr. TRAIN. I think, if you will turn to Mr. Shanly's testimony, you will find that he said exactly that on the stand.

Mr. ALLEN. I think not.

Mr. TRAIN. I think he did, but I will not stop now to hunt it up. I will try to find it while you are making your argument. I so understood him, and I made a note of it, that Mr. Shanly said he did not claim, as matter of law, the first six items upon this schedule in his petition.

Mr. ALLEN. These are the ones he said that he *did* claim as matter of law. He claimed over and over again that he could recover them in the courts, if he could get into the courts.

Mr. TRAIN. Very good ; I shall be perfectly delighted if he will go into the courts. I am ready to let this Committee report a Resolve sending you to a court of law, or into a court of equity, and that is all that any man who seeks to secure a claim against the Commonwealth ought to ask,—to give him the same rights against the Commonwealth that he would have against an individual.

Mr. ALLEN. The question was whether Mr. Shanly so stated.

Mr. TRAIN. I so understood him ; it is quite immaterial ; very likely I misunderstood him ; but I understood him to say that, as matter of law, he did not have any claim against the Commonwealth. I don't understand how he could have. He has taken his money, given his receipt in full, and gone his way. That is generally supposed to end matters between parties, unless there has been some fraud in the transaction.

Mr. MOSELEY. A receipt in full, did you say, Mr. Train ?

MR. TRAIN. I will read it to you, sir :—

“We, W. & F. Shanly, contractors for the completion of the Hoosac Tunnel, hereby acknowledge to have received payment of the Commonwealth for the balance due upon our contract with the Commonwealth, after making certain deductions on account of railroad track not laid, etc., the same being in full settlement of all claims against the Commonwealth, except certain equitable claims for which we propose to ask relief from the legislature. And in pursuance hereof we have surrendered to the Commonwealth the said Tunnel and all property in our hands belonging to the Commonwealth.

(Signed)

“W. SHANLY,

“F. SHANLY,

“*By his attorney, W. SHANLY.*

“No date. Money paid as per receipt on warrant, December 23, 1874.”

MR. MOSELEY. That is hardly a receipt in full, because there is an exception.

MR. TRAIN. It is a receipt in full of everything under that contract. He says he has some equitable claim.

MR. ALLEN. That has reference to the fact that the Commonwealth is not liable to be sued in a court of law.

MR. TRAIN. There has never been a time since my connection with the executive department of the Commonwealth, when, so far as we were concerned, you could not have a right to sue the Commonwealth and test your rights in that mode.

Now, in connection with that receipt, I will call your attention to the language on the fourth page of the contract: We are to pay, “on or before the fifteenth day of each month following the performance of the work, eighty per cent. of the amount of money earned by them, as ascertained and shown by the certificates of the engineer or engineers; and upon the final completion of the whole work herein contracted for and its acceptance by the governor and council, and upon the surrender by the parties of the first part to the Commonwealth, of all real and personal property of the Commonwealth which the Commonwealth will then be entitled to receive from them under the terms of this contract, and in reasonable and proper condition and manner (reasonable use and wearing thereof, and loss or damage by fire or other unavoidable casualty



excepted), and upon the adjustment of all questions growing out of this contract, and the execution and delivery by the parties of the first part of a release of all claims and demands upon the Commonwealth growing out of this contract, then the Commonwealth will pay to the parties of the first part such further sum as may be necessary to make up the full amount of \$4,594,268 : *provided*, that no more than \$3,594,-268 shall be paid until the final completion of said work."

This receipt was made in compliance with that provision.

Mr. CUMMINGS. You have stated that Mr. Shanly, in his testimony, said he did not claim to have any claim in law to the first six items. I understood him to say that those items were known as legal claims. I understood him to say that he had a lawful claim upon those items, but the balance were equitable claims.

Mr. TRAIN. I understood him to say that he did not claim that he had any legal claim to those items; they had been adjusted under this contract, but that the rest were equitable claims. I don't know that it is material to discuss that question. If I misunderstood him, and if he claims that he has legal rights which he could enforce against an individual under those six claims, I am agreed, so far as I can represent the Commonwealth, that he may have the right to sue the Commonwealth and test the legal questions which may arise out of the contract, and get his damages out of a jury, as he would if the contract had been made with any individual. But after that settlement, under the language of the contract, and the giving of that paper, with what he said the other day, that he did not claim that he could enforce those either at law or in equity, that was what I inferred.

That brings us down to what he calls his equitable claims, in reference to which I want to say a word. This petition is a little crafty. I give the claimants credit for being very honest and intelligent men; but they take, by themselves and their friends, every opportunity to impress the public with the idea that they have some equitable claims which ought to be compensated to them in money; and they do not forego any opportunity, either in the newspapers, through their friends, or anywhere else, to make people suppose they have some equities. Well, I understand that if a man has an equi-

table claim, it is a claim which can be enforced in a court of equity.

Mr. ALLEN. Mr. Attorney-General, as you have made that statement, I desire to say, in behalf of Mr. Shanly and myself, that neither of us, either directly or indirectly, have in any manner whatever caused or induced the publication of any piece in the newspapers concerning this claim. I make the statement broadly and unqualifiedly.

Mr. TRAIN. I have no doubt that it is true; but it is just as true, that you have friends who have done so.

Mr. ALLEN. I think you said Mr. Shanly had done it through his friends,

Mr. TRAIN. So far as this petition goes, he has done it. I do not mean to say he has written articles for the newspapers. I will show what I mean by the language of this claim. He sets out in his petition:—

“That in settling accounts with His Excellency, acting Governor Talbot and the honorable council, certain claims for work done outside of the contract, and for delays and damages sustained from causes not within the control of your petitioners, etc., etc., were left unadjusted, as not within the power of the Executive to deal with, but were at the same time characterized as ‘equitable claims,’ for the granting of which your petitioners would have to apply to the legislature.”

Now, the ordinary and natural construction of that language is, that it was language used by the Executive, isn’t it? It is the language used by the Shanlys in this petition. Neither the governor and council, nor anybody else, ever characterized these claims as “equitable claims,” except the Shanlys themselves; or, if they did, it was in saying after the Shanlys had claimed them as equitable claims. “As the Shanlys say they are going to the legislature on what they call equitable claims, we remit the Haupt Tunnel claim to go with them.” That is what I mean, and if you will take the pains to look at the petition to the governor and council, and the report of the governor and council upon it, you will find, I think, that I am exactly right.

Now, an equitable claim, as I have before had the honor to say, is, I understand, a claim which could be enforced in a

court of equity. It is not equitable to come here and ask for charity; but if they can show a claim which, upon a bill in equity, they could maintain against an individual, then it is an equitable claim which you ought to consider or may consider, and you may remit them to the supreme court to have their question tried by a bill in equity, if they choose to accept it.

These claims are four in number. "Errors in original measurements of Tunnel rock; damages arising out of storms of 4th October, 1869; loss of interest from 1st September to 22d December, 1874; interest paid State on advances from drawback."

Now, "errors in original measurement of Tunnel rock" are among the contingencies that the Shanlys undertook to bear when they entered into that contract. There was an error in measurement, amounting to \$22,000 in value, which Mr. Frost discovered, which he communicated to Mr. Laurie, and which Mr. Laurie, who had got into a quarrel with Mr. Frost, communicated to the Shanlys; and then they had a quarrel, the details of which, if you are interested in looking up the history of the matter, you can ascertain; but it finally resulted in Mr. Laurie's being discharged from the work. There is no doubt that, taking the estimates which Mr. Frost had made at the time the Shanlys entered into this contract, there was an error which, if you were to compute their compensation by the amount stated in the schedules in the contract, would make the Commonwealth owe them \$22,000. But this is offset by the fact, demonstrated by Mr. Frost's table or comparative statement, which shows that the actual value of the Tunnel excavation done by the Messrs. Shanly, computed at the schedule rates, is \$78,479 less than the amount set apart for that work in the estimates of December, 1868, and actually paid them in the final settlement under the contract. Subtracting this \$22,000 claimed by the Shanlys from the \$78,479, as shown by the table, and they have gained in the settlement \$56,479. And they are that much better off than they would have been if the contract had been taken as an item contract (*vide* table, page 102, Frost's testimony). But, in any event, I submit that there is no equity in that, any more than there is in the 8th claim,

"for damages arising out of the storm of 4th October, 1869." There is no doubt, I suppose, no earthly doubt, that these contractors suffered serious loss by the want of the Troy and Greenfield Railroad, which they expected to have when they made this contract; but the State was under no obligation to restore that railroad, or to pay them any damages because the railroad was destroyed. Mr. Allen, or Mr. Shanly, I don't know which, alluded to the fact, that the State had done something for the Vermont and Massachusetts Railroad, which had a lease of the Troy and Greenfield Railroad; but that lease, made in 1866, expressly stipulates that the Commonwealth shall make the repairs which were made in consequence of that storm. If you will turn to the lease which was executed between the Commonwealth and the Vermont and Massachusetts Railroad,—it is reprinted in Senate Document No. 150, documents of last year, and will be easily found,—you will find an express stipulation, by which the Commonwealth were bound to make those repairs; the Commonwealth did not do what was done, as a matter of charity, as a matter of gift, or as a matter of equitable claim, but because bound so to do under the provisions of that lease, as I understand it.

Mr. Shanly has furnished us with what he claims under that item of "damages arising out of the storm of October 4, 1869." The first item is, "work done by W. & F. Shanly in removing debris and removing a water-course, etc., \$6,847.23. Received on account, 23d January, 1872, \$3,305.19; balance, \$3,542.04." Well, that matter was adjusted by the governor and council at that time, upon the basis which I read to you, and which you will have before you, known as "the propositions"; and therefore, I will not stop to dwell upon it.

"Work done in clearing out the Farren arch by Hocking & Holbrook, sub-contractors for W. & F. Shanly, \$4,059." That is disposed of also in the same way.

"Sundry subsequent work on water-course by W. & F. Shanly, \$211.13"; leaving the total amount, \$7,812.17.

Well, Mr. Allen, I judge, proposes to say, "If this storm had occasioned that damage, the Commonwealth not having changed that water-course from a mountain stream to a canal, and put in an embankment, we would not have had any claim; but inasmuch as the Commonwealth had made an embankment



there, which proved to be insufficient against that freshet, and that embankment gave way and filled up the Farren arch, the Haupt Tunnel, and the Tunnel itself, therefore the State ought to pay the damages." In other words, he proposes, I take it, to put himself upon the insufficiency of the embankment which the Commonwealth had built to direct or control the course of that brook. The answer to that, it seems to me, is a very simple one, from the testimony of Mr. Frost, Mr. Philbrick, and Mr. Shanly himself. There was a stream whose gentle flow never had done any harm until the fall of 1869. Prior to that time, the Commonwealth had built an embankment; it was built to provide against all ordinary and extraordinary events, and for that purpose was sufficient, in the opinion of the engineers, of whom Mr. Shanly was one. Mr. Shanly knew when he took the contract all about that embankment; he knew all about the Tunnel, he tells you. He had been over the mountain, and had been into the Tunnel; he knew that the embankment was there. He knew that if a deluge, which lasted forty days and forty nights, came down, that embankment might give way; but he knew, as everybody did, that nobody ever expected any such thing, and that that was a contingency that nobody ever undertook to guard against; but for all ordinary and usual perils (and for all *unusual* perils, too, for it would have stood anything but that storm,—nobody ever heard of such a storm on Hoo-sac Mountain before or since) it was built well and thoroughly, as the engineers tell you, and Mr. Shanly knew it; and it was one of the contingencies which he assumed when he executed that contract. He knew that a storm might come to carry away the Troy and Greenfield Railroad, and he knew it would damage him; but he knew if it did, that that would give him no legal claim against the Commonwealth, and no equitable claim, because it was a claim that he could not enforce either in a court of law or in a court of equity. He took that contract with his eyes open. Why does he come here and make a claim against the Commonwealth because of an unexpected storm which did unexpected damage? Why, because he thinks the Commonwealth is able to give, and that he can get a gift, and not because he has any legal or equi-

table claim which he could enforce in any of the courts of the Commonwealth.

Then he goes on to say, "The work in the Tunnel had to be suspended," and he charges \$2,000 for loss of interest; and he charges "for the whole amount due them for west-end losses consequent on the storm, \$9,812.17. The contractors have always held the State to be liable to them for all damages sustained by them at west end of Tunnel from the above cause, or from any cause where the care of the Farren arch was involved, that being specially excepted from their contract."

Now, if you will have the kindness, when you come to consider this question, to take the report of the committee of the executive council, and the propositions which were submitted to the Shanlys, with the approval of my friend, Mr. Allen, at the time this allowance was made, you will find, I think, that that settlement was based upon sound principles.

Mr. ALLEN. Mr. Attorney-General, you do not mean, of course, to represent that I expressed any opinion, one way or the other?

Mr. TRAIN. Not beyond the certificate which is appended to those propositions.

Mr. ALLEN. Which was simply that the governor and council, when the legislature was not in session, had authority to spend money for the protection of the property of the State.

Mr. TRAIN. Yes, sir; that is all I mean to claim. I mean to claim, what I know is true, that no man could have performed his duty more faithfully as attorney-general than you did; and what duties you did *not* perform you must set forth yourself; I cannot tell.

Mr. ALLEN. Thank you.

Mr. TRAIN. We have here a claim of \$9,812.17, which I dispose of by saying, that it was a contingency which he assumed under his contract, and for which he could not enforce any claim, if this contract was between individuals. Then we have the damages at the east end. "The losses suffered by the east end of the Tunnel were nearly all due to the destruction of the railroad between Greenfield and the Tunnel, leaving them without railroad communication with

that side of the mountain for nine months,—namely, from October, 1869, to July, 1870,—and so compelling them to transport everything required for the east-end work over the mountain from North Adams. Even a locomotive engine had to be hauled over.

"Their greatest loss, however, was in not being able to obtain coal, wherewith to work their steam-machinery erected at large outlay to supplement the insufficient water-power. The losses from the above causes were:—

" <i>First.</i> Transportation over the mountain,	. \$2,112 00
" <i>Second.</i> Loss of use of steam machinery, causing the progress of the heading to fall off from its average about 80 feet from January to April, inclusive, while labor expenses remained the same,—say 560 cubic yards rock, at \$11 per yard,	. . . . 6,160 00
" <i>Third.</i> Expended on water-course and re- moving debris, etc.,	. . . . . 850 00
	<hr/> \$9,122 00"

Now, if he had made a contract with the Commonwealth to build a lunatic hospital at Worcester, expecting to move all his building materials, of every description, over the various railroads centering in Worcester, and if an immense storm had swept off all those railroads, so that he had to haul his materials by any other power than steam-power from Boston, or Norwich, or anywhere else, to Worcester, he might just as well turn round and claim damages, as to claim them in this case because the Troy and Greenfield Railroad was carried away.

I am not discussing it now as a matter of charity; I am discussing it as a matter of right; and I say, as a matter of right, it was one of the contingencies which he took when he took his contract, and that he could not enforce any such claim in any court of law or equity.

These several items amount to \$18,934.17; and that disposes of all but the claims for interest. I wish to say, before passing from this branch of the inquiry, that Mr. Shanly has already been considered by previous legislatures on this very

claim which he now makes. I do not doubt that that storm, and the destruction of the railroad, delayed the contractors in the performance of their work, and I do not doubt, of course, that it was an injury to them in the performance of their work; but I say, this storm having occurred in 1869, they have been considered by previous legislatures, and allowances and favors have been shown to the Shanlys in consequence thereof; and that the legislation of 1872, '73, and '74 has all been based, to a greater or less extent, upon these claims of the Shanlys to consideration in consequence of these misfortunes. In 1872, the Shanlys came to the legislature for help, and the legislature were willing to aid them, and they passed a Resolve—chapter 47 of the Resolves of that year:—

“*Resolved*, That the governor and council be authorized to advance to Walter Shanly and Francis Shanly, contractors for the work of constructing the Hoosac Tunnel, the sum of \$100,000 from the fund reserved under their contract for a final payment on the completion of said contract, upon the execution by said contractors, of a mortgage to the Commonwealth, satisfactory to the governor and council, upon the machinery now owned and employed by them in the said work, to secure the repayment of the same, with interest at the rate of five per centum per annum, on demand made by the governor and council.”

That legislation was based upon an appeal made by the Shanlys that they were in need of assistance in consequence of misfortunes which had come upon them during the performance of their contract.

The second Resolve is,—

“That the governor and council be authorized to issue and deliver to the said contractors certificates of the Commonwealth, for the residue of the said reserved fund, payable only upon the final completion of the contract and acceptance of the work by the governor and council,”—and then providing for the form of the certificate.

The third Resolve is,—

“That when the contractors shall have so advanced the work as to comply with the conditions of the contract as to the rate and amount of progress and mode of construction required in its prosecution, the governor and council may, wholly or in part,



at their discretion, remit the reservation of the twenty per centum of the sums thereafter earned under the said contract, for the said reserved fund, and may, if they deem it expedient, pay to the contractors in full such sums thereafter earned."

That was a loan to the Shanlys of \$100,000 at five per cent., and it was placing in their hands evidence of indebtedness, upon which they could raise money to carry forward their work. It was an act of kindness and of favor on the part of the legislature, they having appealed to the legislature to aid them, having been placed by unforeseen circumstances in a situation where they thought it proper for them to come to the legislature and ask to be relieved as much as the legislature chose to relieve them from the stringency of that contract.

Now, take the Resolves of 1873, chapter 48 :—

*"Resolved, That the governor and council be authorized to issue and deliver to Walter Shanly and Francis Shanly, contractors for the work of constructing the Hoosac Tunnel, certificates of conditional indebtedness for the sum of \$200,000, payable to the Messrs. Shanly or order, but to be made payable only upon the final completion of the contract and acceptance of the work by the governor and council; said certificates to be delivered only on the surrender of the \$200,000 of certificates of conditional indebtedness heretofore delivered to the Messrs. Shanly."*

That was a change from the certificates which the Shanlys had at that time.

Then the second Resolve is :—

*"Resolved, That the sum of \$200,000 represented by said certificates shall be reserved and retained in the treasury of the Commonwealth, and an additional sum of \$150,000, until the final completion of the said contract and acceptance of the work by the governor and council, and that, subject to the said reservation, the full amounts already earned or hereafter to be earned by the Messrs. Shanly shall be paid over to them; but interest at the rate of five per cent. per annum shall be charged to and accounted for by the Messrs. Shanly, at the completion of the contract, upon all sums received by them under this resolve, in anticipation of the time when the same would have been received by the terms of the original contract."*

The third Resolution provided that the mortgage of \$100,000 upon their tools and machinery might be released and discharged by the treasurer of the Commonwealth.

Now, that legislation was based upon the same premises as the legislation which is now asked for. When was the proper time, if they wanted to claim any more assistance by reason of the damages which grew out of the storm of 1869, to ask for the whole, and get what they could? Why, it was the first time they came to the legislature. Do you suppose that the legislature of 1872 would have passed these Resolves if they had anticipated or expected that the Shanlys were coming here with a claim of \$130,000, after all this work had been done, and after they had been paid and settled with by the Executive of the Commonwealth? Did the legislature expect that these gentlemen were going to make a claim for anything that had transpired prior to the passage of the Resolves of 1872? Had they not a right to assume that the Shanlys asked no favors beyond what they asked as the basis of this legislation? Has not the Commonwealth a right so to assume, and are you not bound to assume it? Upon what ground, then, can they come here and ask for these damages and for this consideration, when they have already been considered and already been provided for by the legislatures of 1872 and 1873? I fail to see it. It becomes a pure question of charity, and not a question of equity.

Then the items 9 and 10, I think, are most remarkable. They claim "for loss of interest from the first of September to the 22d December, 1874, \$18,000"; and in their statement of that claim, as I recollect it, they allow interest to the Commonwealth at the rate of five per cent., and charge the Commonwealth eight per cent. Well, if an individual were dealing with me in that sort of way, I should regard it as a very remarkable way of putting things. The claim is, that they have a right to do it under their construction of the Resolve of the year 1873, "that the sum of \$200,000 represented by said certificates shall be reserved and retained in the treasury of the Commonwealth, and an additional sum of \$150,000, until the final completion of the said contract and acceptance of the work by the governor and council; and that, subject to the said reservation, the full amounts already earned or here-

after to be earned by the Messrs. Shanly shall be paid over to him."

Mr. Shanly says that everything beyond the \$350,000 was to be paid to them; that there was a large sum, \$170,000, more than the \$350,000, due on the 1st of September, and that they are entitled to interest on that at the rate of eight per cent., to the date of the final settlement; and in his statement, he carries forward the amounts in monthly rests, and gets that result. That is a legal question; there is some law; we can go to the courts on that, if the legislature will be kind enough to pass a Resolution authorizing Mr. Shanly to go into the courts. If his construction of that Resolve is right, the Commonwealth is bound to pay him, at law, that interest, for we have retained money which we had no right to retain in our hands. I am ready to go to the courts and have that question settled; but I submit that that is not the meaning of the Resolution. I submit that the amount of work for which he was to receive his compensation after that Resolve passed, was to be ascertained by the contract precisely as it had been ascertained before; that is to say, by the monthly estimates of the engineers. I said to Mr. Shanly, "You have got \$308,000, more or less, under this charge, 'money earned or to be earned'; will you have the kindness to tell me how much was earned and how much was not earned?" and he couldn't tell; he can't tell to-day, unless he has ciphered upon it since he left the stand. But he says, "I know that the work we did after September did not cost more than \$50,000 and so we ought to have received the money which we received in December, deducting the \$50,000 in September; and therefore you ought to pay us interest on that amount withheld."

My construction of the contract, if it is right, disposes of that; to wit, that the amounts for which they were to be paid continued to be ascertained by the engineers under the contract precisely as they had been before. "The sum of \$200,000 is to be reserved until the final completion of the work, and an additional sum of \$150,000; and, subject to that reservation, the full amount already earned or hereafter to be earned by the Messrs. Shanly, shall be paid over to them. "Well, how are those amounts to be ascertained? Why, they are to



be ascertained, in the absence of any provision in the Resolves prescribing how they shall be ascertained, by looking at the provisions of the contract. Is there anything clearer than that? And the contract determines how the amounts of work for which they shall receive compensation shall be ascertained, so that after September; when Mr. Frost and Mr. Philbrick signed the monthly estimates, instead of the Shanlys receiving 80 per cent., they were to receive 100 per cent. of the monthly estimates. That is all the Resolve amounts to; that is all that anybody ever contemplated that it amounted to; and if anybody had supposed that there was any trap set in that Resolve by which any other result should be gained, that Resolve would never have gone through the legislature of 1873, in my judgment.

Now, for the purpose of determining the amount earned by the contractors from time to time, and for no other purpose, the contract furnishes a list of prices to be taken as the basis of computation. Those prices vary in some particulars, in the different sections of the Tunnel. For example: in the east section, they get for excavation of full-sized Tunnel, per cubic yard, \$11; in the central section, they get for the same work, \$14; in the west-end section, they get for the same work, \$12. Then there is a proviso in the contract that not more than \$3,594,268 shall be paid until the final completion of the work; that leaves \$1,000,000 to be due at that time. The Resolve of 1873, which I have just read, chapter 48, authorizes the governor and council to "deliver to the contractors \$200,000 in certificates of indebtedness, reserving said amount, together with the additional amount of \$150,000, until the final completion of the contract and acceptance of the work; and that, subject to that reservation, the full amounts already earned or hereafter to be earned by the contractors, shall be paid over to them." Now, what does that mean? That is the question. Why, it means, "the full amounts already earned or hereafter to be earned," on the prices and upon the basis stated in the contract; it could not mean anything else; and not in the proportion which the work done bears to the whole work, which is the claim of Mr. Shanly. If the excavation of the Tunnel in the central section had all been made from the eastern and western sections,



instead of through the central shaft, the earnings would have been for that work, and the rates prescribed for those sections ; to wit, \$11 and \$12 per cubic yard, instead of \$14, as prescribed in the contract for the central section of the work.

Now, I submit, that the language of the Resolve must be construed in accordance with those principles, and therefore I understand that the executive department acted precisely in accordance with the true intent of that Resolve ; and that the claim made here upon the other side, that the governor and council did not carry out the intent of that enactment towards the contractors, is not true. I want to say, however, that if the item of \$198,164, for which interest is charged for seven months, were reckoned at six per cent., it would amount to \$6,935.74. Had that amount been advanced under the Resolve, interest at five per cent. would have been charged upon it to the contractors ; so that the difference, as finally made up, would have been one per cent., or \$1,155.95.

If it be true, that the destruction of the Haupt Tunnel actually delayed the completion of the contract, and but for such destruction the contractors would have completed their work about the first of September, 1874, then all they could be possibly entitled to would be interest on such sum as they would have been in a position to claim at that time, and Mr. Shanly states that sum to be \$548,164. If, therefore, the facts show that the contractors have a claim for interest, either in law or in equity, what should be the rate? The interest charged to them by the Commonwealth upon the advancement of a million and a half of dollars, was five per cent. ; but leaving this out of the question, clearly they cannot have any claim for a higher rate than the legal rate in cases where no agreement is made between the parties. I do not understand how there can be an equitable claim for a higher rate of interest than the legal rate, nothing ever having passed between the parties in relation to the amount to be paid, so that the items of interest may be stated as follows :—

Item No. 1, . . . .	\$548,164 00	
For one month, . . . .		\$2,740 82
Item No. 2, . . . .	514,264 00	
For one month, . . . .		2,571 31
Item No. 3, . . . .	433,264 00	
For one month, . . . .		2,166 32
Item No. 4, . . . .	411,764 00	
For seven days, . . . .		481 55
Making a total of, . . . .		<hr/> \$7,960 00

That is the difference between five and six per cent. I have been rather careful with that, because I thought great stress was laid upon it, and that it was due to the other side and to you to state it exactly. That is the loss of interest from the first of September to the 22d December, 1874.

Now, item No. 10 is a claim for "interest paid the State on advances from drawback." I should like to know why they are entitled to anything in law or in equity for that? They made a contract by which the State was to withhold and have in its possession at the completion of this contract \$1,000,000. That contract was modified from time to time, but it was a part of their contract, which reduced the actual prices named in the contract to be paid to them for the work by the amount of interest which the money to be withheld by the State should earn during that period. It was a part of their contract, just as much a part of their contract as the sum stipulated to be paid by the Commonwealth.

Now, when they put it in that form, I say it would have been much more manly, in my judgment, to ask the Commonwealth to give them \$31,620.40. They made that contract, as you and I make contracts; there is no difference between the Commonwealth and an individual in that respect. The Commonwealth, when they make a contract, are to be held to their duty, and the individual is to be held to his duty. Is there any different rule of conduct, in law or in equity, to be prescribed, as affecting a contract where the Commonwealth is a party, from that prescribed where the contract is between individuals? I submit not. If a man makes a contract with his fellow-man, he is made to stand

to it, and if he does not stand to it he pays damages for the breach. If he loses money by his contract, he pockets the loss, and goes his way. Is any different rule to be adopted between parties who contract with the Commonwealth? With what face can a man make a contract with the Commonwealth, and then, because he has not made any money, or has not made so much as he thought he ought to have made, come and ask the Commonwealth to make it up to him? He would not come to an individual and ask him to make it up. If the Commonwealth had lost by the contract, he would not pay anything to the Commonwealth. The Commonwealth might just as well have done this work by the day, as to have done it by contract, if such a rule of construction is to be applied. It is "heads I win, tails you lose," upon the Shanly construction of this contract! "If I make money, I am going to pocket it, and carry it off to Canada. If I lose money, I have nothing to do but to come and hang around the State House two or three months, and I will get it out of the legislature." I submit that that is not any rule to be adopted by legislators in the general court of Massachusetts, which is the highest court in the Commonwealth. From the time when Mr. Shanly first came here, in 1872, down to now, he has been continually coming to the legislature, and as constantly been treated with kindness and favor. He will not say that he has not received at the hands of the governor and council, and of the different legislatures to whom he has made application, every courtesy and kindness to which he was fairly entitled. A controversy arose between him and the Commonwealth, last year, as to the amount of arching to be done under that contract; the governor and council insisted that he was to make a safe Tunnel, and if that required the whole Tunnel to be arched, he was bound to do it. He says, in the first place, that my construction of the contract was wrong, and I think very likely it was; but the governor and council said, "If the Shanlys are dissatisfied with that construction, tell them we will go to the courts with them and have the contract construed"; and I made them the offer; it is in the archives of the Commonwealth, in the report of the committee of last year. They would not go to the courts, and why? For two reasons: in



the first place, they said they had got the opinion of Mr. Sidney Bartlett, which made it perfectly certain that their construction was right. Well, if they were certain of it, why should they be unwilling to go to the supreme court and have it adjudicated? I never could see why; but they would not go. In the second place, they said, "If the construction of Mr. Train is right, if the construction of the governor and council is correct, we cannot perform the contract; we must fail." I said, "Very well, if that is the case, if that is the ground on which you put it, then come and ask to be released from that contract, and I have nothing to say about it. If the legislature chooses to relieve you from the operation of that contract, very well." (*Vide* Sen. Doc., No. 300 of 1874.) And out of that grew the legislation of last year, under which this settlement has been made by which they were relieved. It is chapter 365 of the Acts of 1874. It took this form, but it relieved them from an expense of at least \$350,000, which they were bound, in my judgment, to have expended under that contract, for arching that Tunnel.

"SECTION 1. In addition to the provisions contained in the contract with W. & F. Shanly, of December 24, 1868, the governor and council are hereby authorized to expend not exceeding \$300,000 in making the necessary excavations for, and in the construction of, archways in the eastern and central divisions of the Hoosac Tunnel: *provided*, that nothing in this act shall be deemed to change, or in any way impair the effect of said contract, except as to the making of the final settlement as provided in section three.

"SECTION 2. The sum of \$300,000 is hereby appropriated to be expended for the purpose specified in the preceding section, the same to be raised in accordance with the provisions of section three of chapter 333, Acts of 1868.

"SECTION 3. The governor and council may make a full and final settlement with said Shanlys, under the contract of December 24, 1868, without waiting for the laying of the railroad track through the Tunnel, the completion of which may be delayed by the work of arching above provided for: *provided, however*, that a sufficient sum shall be reserved to cover the cost of completing said track; and *provided, further*, that said contract shall be otherwise completed to the acceptance of the governor and council."

When the Messrs. Shanly came and said, "We cannot do that arching; if we are bound to do it, we must fail and stop



where we are," the legislature appropriated what it was thought would be necessary to do that arching, independently of the contract, and authorized the governor and council to settle with the Messrs. Shanly, pay them the balance, and let them go their way.

Mr. Shanly has been here ever since 1872, asking for that legislation. I say he comes here as a matter of charity ; that he has no claim that can be enforced in a court of law or in a court of equity, because he refuses to go there to enforce it. He reminds me very much of the beggar who, when a man handed him ha'pence, and told him to go his way, replied, "I won't go ; I never go away short of sixpence !" He has had his ha'pence from the Commonwealth over and over again, but still he is not content ; he wants his sixpence. If it is the right and duty of the legislature to make the Messrs. Shanly gifts, make them ; that is none of my business. I do not imagine that the legislature, when they passed the Resolve directing me to come here, intended that I should tell you what was or was not proper, so far as that line of policy is concerned ; but when they come here and plant themselves on legal grounds, or equitable grounds, then I think, unless the claim comes within the classes which I indicated at the outset of my argument as proper matters for consideration by the Committee on Claims,—that is to say, claims which are not in themselves legal, or are not in themselves equitable, so that, if it was a claim against an individual, the petitioner would have his remedy in the courts,—then I think the most the legislature ought to be expected to do, the most any claimant has a right to ask, is, that he shall be enabled to go into the courts and establish his claim as he would if his contract were with an individual ; and that, as far as my experience goes, the Commonwealth have always been willing to accord to him heretofore. He refused to accept it last year. I think he ought to be required to take that or nothing this year ; but of that you are to judge in the report which you shall make to the legislature, and the legislature itself finally to determine.

I do not know why, if you are to grant Mr. Shanly any sum of money this year (it would be, of course, a gift from the treasury to him), he may not come next year, and the year

following, and any number of years, and, with a new committee, and upon a new claim, or an old claim dressed up in some new apparel, obtain another appropriation, and so on until the end of time. I hold that the same rule should be applied to this contract as if it was a contract existing between individuals. If Mr. Shanly made money, we are glad of it, and were bound to pay him. If he lost money, we are sorry for him, but are not bound to make his loss up. He took the contingencies and the risks precisely as individuals would have done, and with that he must be content.

I believe, gentlemen, that I have wearied you by the time which I have occupied in this discussion; but I have endeavored to say no more than seemed to be absolutely necessary for the proper performance of what I conceived to be my duty. The evidence has all been carefully reported by Mr. Yerrinton, and will be before you. I have no doubt the result to which you will arrive will be satisfactory to all parties. At any rate, whether it is or not, we are bound to accept it, and I trust it will be the end of these claims on the part of these contractors.

Mr. MOSELEY. I should like to ask you one question. Did I understand you to say that you thought the legislature has not the right to pay Mr. Shanly, but that he should go to a court of law?

Mr. TRAIN. I say that Mr. Shanly places his claim on two grounds now. He says substantially, "If I was dealing with an individual, I could sue him, or I could bring my bill in equity against him; but, dealing with the Commonwealth, I can't do either." Now, I say, all you ought to do is to place him in the same condition as though his contract were with an individual, so that he might try his rights in the courts. That you can do by passing a Resolve. I do not mean to say that you cannot give him money; you undoubtedly can; but I mean to say, that it would be an honest, conscientious and proper discharge of legislative duty to give this man a right to try his claims, either at law or in equity, or both, before the courts of the Commonwealth.

Mr. MOSELEY. You spoke of the legislation of 1872 and 1873. What do you think would have been the effect in regard

to finishing the Tunnel, if the legislatures of these years had declined to grant the request of the Messrs. Shanly?

Mr. TRAIN. Well, they would have had to go elsewhere and borrow the money. I am glad you spoke of it.

Mr. MOSELEY. Wouldn't it have stopped the Tunnel during the process?

Mr. TRAIN. O, no; not if they could borrow the money elsewhere. I am glad you have called my attention to that, although it involves a little more speech. I meant to have spoken of it. They have paid \$282,000 in interest during this contract. Mr. Shanly tells you that his whole interest and insurance account is \$292,000, of which some \$10,000 was for insurance. Now, he comes here with his claim, and it is only another mode of asking you to pay him interest on capital which he had not when he entered into this contract. He came and got the Resolves of 1872 and 1873 as a mode of relieving their financial difficulties. If he could have got his money anywhere else, he would have done so, if he could have got it on as good terms as he got it under those Resolves.

Mr. MOSELEY. Would it not have suspended the contract, caused him to fail, and obliged the State to make a new contract?

Mr. TRAIN. I never heard of it in 1872 or 1873. Nobody ever heard that the Shanlys claimed that they could not perform that contract, until they were required to do the arching last year; but they wanted financial assistance, and they got it through those Resolves. If they had not got it through the legislature, they would have gone elsewhere and obtained it; but they would have had to pay a higher rate of interest. They would have gone into the market and got the money where they could. It is perfectly clear that these men were financially unable to shoulder this contract when they undertook it, because, as Governor Talbot, I think, said, Mr. Shanly spent a great deal of time running round borrowing money to carry on his work. That is perfectly obvious, from the fact that here is an interest account, in four and a half or five years amounting to \$282,000, showing that they were doing the work under very great disadvantages.

Mr. ROBINSON. Is that in addition to the loss of interest which they claim to have suffered by the State?

Mr. TRAIN. I think that is outside. I think they have actually paid \$282,000 for money borrowed to carry on this work, in addition to these claims. If I am not right Brother Allen or Mr. Shanly will set me right.



## ARGUMENT OF CHARLES ALLEN,

IN BEHALF OF MESSRS. W. &amp; F. SHANLY, MARCH 25, 1875.

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MR. CHAIRMAN AND GENTLEMEN OF THE COMMITTEE :

The present petition rests upon the general ground that the petitioners, having entered into the largest contract, perhaps, to which the Commonwealth has been a party, and having performed the same on their part, have encountered such difficulties, and been subjected to such extraordinary expenses in the execution of their work, without fault on their part, and resulting on the whole in a heavy loss to them, that they are entitled to call upon the Commonwealth, in justice and fairness, to make up their loss.

Of the propriety of this mode of proceeding there can be no doubt, and it is the only method open to them of obtaining relief. For this purpose, the legislature represents the Commonwealth, and *is* the Commonwealth.

The attorney general urges upon you that the petitioners have no standing here ; that if they have any such claim as would be the subject of a suit at law or in equity against an individual, then they should be remitted to the courts by a special Act to be passed for that purpose, enabling them to sue the Commonwealth ; and if they have not such a claim, then they should not be listened to for a moment.

The legislature will not sanction that position. Neither the Commonwealth nor just men deal in that manner with persons with whom they contract. It is the boast of many an honest man, that no one was ever compelled to sue him in order to obtain justice. Fair-minded men do not say, and the Commonwealth does not say, to those with whom they contract, "If you have any claim against me, sue it. You'll not get a cent unless you establish it in court, according to

the strictest rule of law." No fair man says that. Courts are established as a *final* tribunal to settle matters which parties cannot settle among themselves. These petitioners hope that there is no need of any other tribunal, to arbitrate between themselves and the Commonwealth; but that if their petition is fair and just, it will be allowed without a lawsuit.

#### RECENT HISTORY OF THE TUNNEL ENTERPRISE BEFORE THE SHANLY CONTRACT.

After General Haupt left the work, in 1861, Governor Andrew appointed J. W. Brooks, S. M. Felton and Alexander Holmes as a board of commissioners to investigate the whole subject of the Hoosac Tunnel enterprise, and report their conclusions.

They employed Mr. Latrobe of Baltimore, an eminent engineer, afterwards in the employ of the State; Mr. Laurie of Hartford, to make the necessary surveys, examinations and estimates of the cost; a gentleman highly recommended by them for ability and integrity, and deceased since these hearings begun; and Mr. Storrow, to go to Europe and examine the European tunnels; and in 1863 they submitted a most elaborate report of their own, giving the results of their practical judgment, as successful, eminent and accomplished railroad men, together with the full reports of the several engineers whom they employed. These reports made a volume.

So far as science, skill, engineering ability and practical success in great railroad enterprises were concerned, it seemed as if the Commonwealth had enlisted in its behalf whatever was most likely to lead to a favorable result. At the outset, it appeared that every preparation had been made which matured wisdom could suggest, and the State entered upon the prosecution of the work with vigor, and lavish expenditure of money, and much hope and confidence, under the superintendence and care of the three commissioners.

The work was prosecuted for a while under these commissioners, and then under their successors till December, 1868, when the Shanly contract was made.

The result is known. The plans did not succeed. No satisfactory progress was made. The public money was

spent with no adequate return. The whole enterprise bid fair to be a wretched failure.

It is painful to go over the history of those years, as exhibited in the public documents of the Commonwealth; to read the record of disappointed hopes, of baffled exertions, of hopeless struggles for a result which could not be attained. But some illustrations must be given. In May, 1866, the minority of the finance committee, consisting of Henry L. Pierce and J. W. Candler (House Doc., 1866, No. 403, p. 9), say:—

“The actual results are such as might have been anticipated from an organization so defective. Uncertainty in plans, ill-considered theories and lavish expenditures without adequate progress, have characterized the doings of the commissioners.”

In House Doc., 1867, No. 30, Mr. Latrobe, the engineer, shows that the expenditures *under the commissioners* on the Tunnel, including the Deerfield dam, to November 1, 1866, were \$1,482,973.20. This did not include the amount expended under General Haupt. The work then done was 131 feet of Tunnel called finished, at both ends—the size then being only  $14 \times 19$ —and 5,823 feet of heading.

The legislative committee of 1867, in their report dated in March, 1868 (Senate Doc., 1868, No. 102, p. 3), say:—

“The Committee feel that the progress and reputation of this enterprise have suffered too much and too long from interruptions and delays, arising from causes that good business judgment and engineering skill should have *long since* securely provided against.”

This report presents a pitiful account of the delays and difficulties which encompassed this work.

There was no unity of plan among the commissioners themselves.

Mr. Shute withdrew, and in March, 1866, wrote a paper explaining the causes of his withdrawal. This was a bitter paper, and the House refused to receive it on account of its personalities; but it was afterwards published, and in it Mr. Shute refers among other things to “the absence of any competent engineer directly responsible to the commissioners,”

and speaks of "the present unsatisfactory and almost hopeless condition of affairs" (pp. 15 and 16).

Before this, the House had requested Governor Bullock to furnish, for the use of the legislature, any communications received by him in relation to the Tunnel, from any of the commissioners or the consulting engineer; but he declined, in a special message, in which he referred plainly to the dissensions which had existed in the board. (See Blue Book of 1868, p. 335).

Mr. Hudson, another of the commissioners, made a report, which was returned by the governor because it reflected injuriously upon the manner and methods of arrangement adopted by the superintendent of the work. But the House committee afterwards recommended its publication, and it was printed. (See House Docs., 1868, Nos. 353, 359).

These things are referred to, for the purpose of recalling the desperate condition of the enterprise at that time. With a plenty of ability in different individuals connected with the work, there was a lack of united and harmonious action, which made everything seem hopeless.

Certain persons had for years expressed the opinion that the Tunnel never would be done, unless upon the contract system; but it was feared that no responsible contractor would be found with means and courage sufficient to undertake the whole work.

At the time of making the Shanly contract, the cost of the Tunnel, *without interest*, as given by the commissioners, was \$3,002,176.57. (Senate Doc., 1869, No. 6, p. 11.) This, in round numbers, is two-thirds of the amount of the Shanly contract. At the east end, the total distance penetrated was only two feet over one mile, of which only 810 feet was then supposed to be finished; at the west end, a little over three-quarters of a mile was penetrated, the bulk of it, east of the Farren arch, by a small heading only.

#### THE WORK AND LOSSES UNDER THE SHANLY CONTRACT.

Under these circumstances, Messrs. Shanly entered into their contract, December 24, 1868, and commenced actual work upon the headings in the spring of 1869, and thereafter prosecuted it continuously to its completion. The contract



price was arrived at by applying the detailed bids of Messrs. Shanly to Mr. Frost's estimates of quantities, and adding up the items, as shown by the schedule introduced in evidence.

It was known at the outset to be a difficult task, and one attended with many risks. Doubts had been entertained by many, whether any responsible contractor would undertake the work, without a very large margin of profit. Mr. Brassey, the great English contractor (recently deceased), told Mr. Storrow that "the enterprise has all the contingencies and uncertainties of an untried project, and it would be unsafe to undertake it by contract." (See Mr. Storrow's report, p. 44.) The Brooks commission held the same opinion (p. 56). But the contractors, undertaking to do this work according to certain *average* rates, and not, as seems to have been supposed, to maintain those rates during each and every month, have pressed on, in spite of difficulties anticipated and unexpected, and have overcome them all.

They have not been conquered by the stringency of the money market, through two seasons of panic, bringing widespread disaster and ruin to many other enterprises; by numerous material obstacles developing with the progress of the work; by greatly increased expenses of working, induced by causes beyond their control or power to anticipate; or by the rigorous exactions of the engineers, who assumed to direct and control their work in methods not deemed wise or economical by the Messrs. Shanly, with a stringency increasing with the increased difficulties, and to retain from them unjustly large amounts of their earnings,—an element of expense and annoyance which the pride and magnanimity of Mr. Shanly have prevented him from displaying unnecessarily to the public view, but which nevertheless he has felt most keenly himself.

In spite of all these, the end crowns the work.

At our very doors, the fine figure of Robert Collyer becomes an accomplished fact :—

" ' We want a railroad into Italy ' cries the world, ' and cango no farther for this mountain ; what shall we do to find a way ? ' ' There is no way,' heaven answers, ' except to your own persisting ; but if you seek, you shall find ; if you knock, it shall be opened unto you.' The knocking is with hard steel at the hard rock, and it is only a

question of persistence and of endurance ; then at last it has come to pass that even the heart of the unwilling mountain is won, and its midnight sleep driven away ; and where for countless ages there has been only an utter and unutterable silence, there is now the mighty response of an answered prayer in the thunder of the locomotive."

This has been accomplished through the persistence and endurance of Walter Shanly.

If in respect to one portion of the work there have been differences of opinion between himself and the engineers, it is unfortunately nothing new in the history of this great work ; nor have they been greater than the differences which have existed, and still exist, between the engineers themselves.

If he has not always followed in detail the course which they deemed wise, he can at least point to a tunnelled mountain as the result of his own methods.

In the prosecution of this great work, the Messrs. Shanly have lost a large sum of money. They have expended much more than they have received. So far as they are concerned, the Commonwealth has got its Tunnel for less than its actual cost. Their hopes of reasonable profit under their contract long since disappeared, and for the last three or four years it has been simply a question, with how small a loss they could complete the work. They have completed it ; they have summed up the figures ; and, after allowing for machinery and tools on hand, find a net loss of \$226,495, made up to January 1, 1875. No question is raised as to the accuracy of their book-keeping ; their system was apparently a perfect one. Mr. Frost found all the items right which he examined. They have exhibited a chart showing their expenses in detail.

Assuming that, on the whole, they have done the work with reasonable economy, this shows the amount below actual cost value at which the State receives the product of their labor, skill, anxiety and risk, for nearly six years of continuous service. Of course no contractor would enter upon such a piece of work if he thought there was any chance of such a result. And now, looking back, what price would a contractor ask, with the knowledge now obtained, for undertaking what the Messrs. Shanly have performed ? What price would an engineer call a fair contract price ?

They do not ask the legislature to give them the fair and honest money value of their work, reckoned by any such standard as that; but they would show you how it happened that their reasonable expectation of profit was disappointed; how their expenses were swelled, without any fault of their own, beyond all previous calculation; how they have rendered beneficial service outside of the requirements of their contract, which is fairly entitled to favorable consideration; in the hope that, without too much reference to legal or narrow questions or considerations, it may be deemed, under all the circumstances, more consistent with the character, the good feeling, the sense of justice of Massachusetts, not to receive this work from the contractors at less than its actual cost to them.

Their unexpected and increased expenses came from several sources.

#### FAILURE OF DEERFIELD RIVER DAM.

For the purpose of furnishing power to drive the machine-drills, the Commonwealth had built a dam across the Deerfield River, and incidental works, at an expense of \$258,000. From seeing such a large expenditure, a contractor coming here from abroad might naturally suppose that the water-power could be relied on as sufficient. The Messrs. Shanly were under this impression. But it proved insufficient. It was a subject of comment in Mr. Frost's reports during the summer, and is indeed a matter of common knowledge. The Messrs. Shanly were obliged to build steam-works to supply the deficiency of water-power, at an original cost of about \$18,000, and the extra expenses of driving the compressors was about \$10,000 more.

#### GREAT STORM OF 1869.

Then came the great storm of October 4, 1869, unprecedented in its violence and destructive power, and still fresh in the memory of us all. Its effect upon the Tunnel has been more than once described in official reports. The east and west ends were both flooded, one man was drowned, and there was much material injury, besides loss of time.

What should be done?

In Helps's life of Thomas Brassey, it is said,—

“In the execution of any great undertaking, Mr. Brassey's anxiety was that the work should be done quickly, and be done well. The minor questions as to who should bear the expense of minor matters, unprovided for by specific contract, he left to be settled afterwards; whereas many men, perhaps I may say most men, would have insisted beforehand upon the question being settled as to who should bear the outlay.” (Page 16.)

From what was done, not only in respect to the damages caused by this flood, but many other matters which have come before you, it is apparent that this description of Mr. Brassey is strikingly applicable to Mr. Shanly also.

Without a day's delay, without stopping to settle in advance, or even to raise any question who should bear the expense, he at once began the work of restoration at both ends of the Tunnel.

The injury at the west end was caused in this manner: The State had diverted the water of a brook through an artificial water-course adjoining the Farren arch (which is the west end of the main Tunnel), not in any manner connected with the work of Messrs. Shanly, but wholly within the limits where Farren's work extended; and had built the banks of this canal so insecurely that the water broke through, washed away a large amount of the material covering the Farren arch, down into the space between the Haupt Tunnel and the west portal of the main Tunnel, so that a dam was made which set back the water and a large quantity of material into Farren's arch, and the water flooded the Tunnel for the whole length then constructed there.

This is thus described by the legislative committee of 1869 (Sen. Doc., 1870, No. 58, pp. 9 and 10):—

“The progress of the work at the west end was seriously interrupted by the October freshet, which caused the water in the brook, which formerly crossed the line of the Tunnel, *but had been diverted by the State into a canal*, to break through the artificial bank into the Tunnel, the water carrying with it great quantities of earth and stone and entirely filling it in a few minutes, drowning one man and the rest escaping with difficulty, and doing damage to the work, as



is stated, to an amount somewhat less than \$10,000. This caused an *entire* suspension of the work at the west end, so far as progress is concerned, for three weeks, and an interruption to the usual rate of progress for a longer period." (See, also, Senate Doc., 1871, No. 55, p. 15.)

Later in the month, the Messrs. Shanly presented a claim for reimbursement to the governor and council, and in a communication dated October 21, 1869, setting forth their views in detail, they say :—

"In thus promptly striving to protect the property of the Commonwealth and to restore the Tunnel to the condition it was in previous to the storm of the 4th of October, the contractors assumed no responsibility for the cause of the accident, or any liability for its results. They had the means for prompt and efficient action at their disposal and applied them in good faith and as good neighbors, *and will continue to carry on the work of restoration till completed*, in the fullest confidence that, for the great expenses they have incurred and the losses they have sustained, the Commonwealth will hold them harmless."

The executive officers considered that, as the breaking away of the water injured both the Commonwealth and the Messrs. Shanly, both parties should join in bearing the expense, according to certain rules laid down by themselves.

To this the Messrs. Shanly replied at length, saying among other things :—"They affirm that their neighbor, the State, *had no right to inflict injury on them in the first instance*; and, secondly, that having so injured them, it has no right to make gain out of its own wrong-doing," as it would, by the work of the contractors in restoring the property of the State, and making the banks secure for the future.

The state officers did not, however, recede from their position, and finally, on January 23, 1872 (not till then), made a payment of \$3,305.19, which Messrs. Shanly received, making at the same time a written protest that they did not waive their claim for payment in full. Their statement shows a balance of \$9,812.17 due on this account, including certain work done by their sub-contractors, Hocking & Holbrook, amounting to \$4,059. The accuracy of the items is not questioned.

Upon this plain statement of facts, it is not apparent what valid reason there was then, or is now, for refusing to pay this amount. If the State had built its canal securely, this injury would not have happened. The loss arose wholly from the failure of the State to make its canal safe. The banks built and maintained by the State were insufficient, and when the storm came they gave way. There is no ground of equity or of law on which the State ought to be exempted from bearing this loss. The Messrs. Shanly were not bound to take into consideration that the State might leave its canal insecure.

The item for clearing out the Farren arch rests on the same grounds. This was, clearing out the rubbish which remained until 1874. It was the residue of the material brought in by that storm of 1869.

At the east end, the railroad was washed away between the Tunnel and Greenfield, so that it remained unused for about nine months. This made it necessary to haul everything required for the east-end work over the mountain from North Adams; and it cut off the contractors from the use of coal for their steam-engines, erected to supply the deficiency in water-power. The weekly reports of Mr. Frost contain constant references to the labors of the Messrs. Shanly in restoring things to their former condition; the delays and difficulties from anchor-ice and from the lack of coal. They need not be cited from, in detail, because the fact of the loss is not questioned. They afford a vivid picture of the troubles of that autumn and winter, resulting from the great flood.

The losses to the Messrs. Shanly at the east end from this cause, are estimated at \$9,122, as shown by the statement furnished.

In judging of this matter, you are not without the advantage of a precedent established by two former legislatures. The railroad between Greenfield and the Tunnel was under a lease to the Vermont & Massachusetts and Fitchburg Railroad companies, with covenants making it their legal duty to restore the railroad, where it had been washed away. The attorney general argues that the Commonwealth was legally bound to make such restoration. Such was not the opinion

entertained by his predecessor. The opinion of the attorney general of that time to the contrary, is found in House Doc. of 1870, No. 323, pp. 6, 7, and after insisting that no *legal* duty rested upon the Commonwealth, contains in conclusion the following :—

“ At the same time, this construction, which I think is required by the application of the rules of law, seems to me in this instance, as in others where it has sometimes been applied by courts, to be harsh and oppressive upon occupiers of property belonging to others ; and as a matter of justice I quite agree with the report of Mr. Appleton, submitted to me, that the loss fairly traceable to the unusual and extreme violence of the storm, should be borne by the Commonwealth, it probably not having been in the minds of the parties at the time of execution of the lease.”

These railroad companies would do nothing towards the work of restoration, until after legislation by which the State assumed the great bulk of the expense ; and by the statute of 1870, chap. 252, and 1871, chap. 153, allowances were made under which they received a little over \$140,000 in money, and an abatement of nine months' rent for the railroad. This action was taken after written reports by the attorney general, and by one of the railroad commissioners, and after an investigation in the executive department, as well as before different legislative committees.

Thus, the legislatures of two successive years have recognized the justice of relieving the Vermont & Massachusetts and Fitchburg Railroad companies from their obligations under their contract with the State, and have made good to them the whole damages traceable to the unusual and extreme violence of this storm, upon the line of the Troy & Greenfield Railroad. Is their position in relation to this enterprise so much more meritorious than Mr. Shanly's, that the Commonwealth, in the face of the world, can be willing to say :—“ To our own railroad companies, with whom we have contracted, we will make good their loss, to the amount of \$140,000 in cash, and abatement of nine months' rent. To these contractors, who have come here from another country, trusting to the honor and good faith of Massachusetts, and who have rescued this enterprise from the almost hopeless discredit

into which it had fallen, and made it respectable, we will *not* make good their loss of \$18,000."

#### WATER DIFFICULTIES IN CENTRAL SECTION.

The great and overshadowing element of increased expense is found in the unexpected influx of water in the central shaft workings, and the action of the state authorities in requiring the Messrs. Shanly to undertake to cope with it, contrary to their own judgment.

This influx of water was unexpected. The opinion was generally entertained that no serious trouble in tunnelling the mountain would be met with from this source. President Hitchcock, in 1854, gave an extended description of the geological characteristics of the mountain, summing it up by declaring that he thought the Tunnel would be found dry, after penetrating a considerable distance from the surface, and gave his reasons for it. This opinion was generally followed. The commissioners appointed by Gov. Andrew, say :—

"Our estimate [of cost] will be based upon Pres. Hitchcock's opinion, the highest attainable authority, that the quantity of water to be met with, except in the secondary formation at the west end, *will not be so large as to be seriously troublesome.*" (Page 54.)

Mr. Latrobe likewise founded his estimate of the cost of the Tunnel upon the same assumption.

Without pausing to dwell upon other opinions which might be cited, the deliberate judgment of the official representatives of the legislature, at the time when this contract was entered into, is found recorded in the report of the joint committee of 1868, on the Hoosac Tunnel (Sen. Doc., 1869, No. 61, pp. 12, 13), in these words :—

"Beyond the [west] shaft, *all the rock is self-sustaining*, and will be found so throughout the mountain. As Prof. Hitchcock has said in another connection, 'it would be a thing unheard of in geology, were it otherwise.' The chance of a great influx of water during further progress of the Tunnel, is very remote and improbable, and however great it may be, it will discharge itself at either end by natural flow. . . . The proofs derived by actual inspection at the east end, central shaft and west end *are morally irresistible*



in forcing the conclusion that *progress at all points is to depend hereafter solely on the greater or less hardness of the material, and the greater or less efficiency of the means that may be devised for breaking it up.*"

This they emphasized by italics, as if to show that no doubt was to be entertained.

Messrs. Shanly shared in this opinion, and the character of the rock throughout the whole 445 feet sunk by them, and for a short distance of tunnelling to the westward from the shaft, was a clear confirmation of it. Everything had been made ready, in expectation of rapid and continuous progress. The sides of the central shaft had been trimmed, the machinery put in perfect order, excavations by hand-work had been made sufficient for the use of the large carriages for machine-drills, and these had been lowered and put in place for the westward work. All this having been done, in March, 1871, the water was struck.

At this date, they had already made up for the loss of time consumed at the outset in the work of preparation in the east and west-end workings, so that both were a little further advanced than the contract required; and they were now proceeding at the rate of ten per cent. in excess of the contract rates. Mr. Philbrick himself testifies to this. Their pneumatic drills, already ordered, and to be applied as soon as the requisite room should be obtained, were soon to give a material increase to this excess. Coming east from the central shaft, there was no reason to doubt that the same advanced rate might be maintained. This was the situation when the water was first struck.

Mr. Shanly's description of the subsequent difficulties from water has been laid before you by himself, in the following written document.

[Mr. Shanly's statement, printed on page 19 of the testimony, was here read.]

Mr. Frost's description of the same, for 1871, may be found in the Sen. Doc., 1872, No. 250, p. 10.

The difficulty from the great influx of water was of the gravest description that can be imagined. In November, 1871, Messrs. Shanly had provided pumping power for

raising 200 gallons of water per minute through the central shaft. They represented to the governor and council the danger that would be incurred in seeking to force the heading westward. Mr. Crowell, who is described by Mr. Philbrick as the active member of the council committee at the time, is called by the attorney general, and testified to you in these words :—

*“I think we concluded that it was not perhaps wise for us to insist upon his pushing the work west from the central shaft. . . . My impression is now that Mr. Philbrick said something to me to the effect that with more pumps there the water might be removed, and they could proceed with the work; but it was questionable, I think, with the council at that time whether he would not find more water, and more than he would be able to remove with another set of pumps, even.”*

It seems, however, that Mr. Philbrick's view finally prevailed; and the order was given (contrary, as it would seem, to the judgment of the council, and reversing the conclusion that they had originally arrived at) that the work must be resumed at all hazards. There was no alternative for the Messrs. Shanly; so they recommenced, and had made about 127 feet of progress, when the increase of water was so great that they stopped again.

It was now obvious that the water was likely soon to overpower the pumps. The flow was already at the rate of about 140 gallons per minute. To Mr. Shanly's mind, it was a plain proposition, that to press on in the face of this was attended with extreme danger. It seemed to him that no competent engineer could come to a different conclusion. But on the 2d of March, 1872, Mr. Frost sent to them a letter containing the following imperative order :—

*“I have to notify you of the conclusion of the executive council, that you must be required to resume at once the progress at the heading westward from the central shaft.”*

It has been made known, in the present hearings, that Mr. Frost's order was written in consequence of a letter from Mr. Philbrick, saying that the governor and council were “unanimous in the opinion that the contractors should be

required to resume work *on the western heading at once*, and prosecute that point, as well as the enlargements both ways, as required by the contract."

Mr. Frost testifies to you frankly that, at the time of giving this order, he thought the wise way of proceeding would be, not to undertake to make progress westward until more pumps had been provided. He was questioned closely upon this subject by a member of the Committee (Mr. Lovering), and was as little equivocal in this opinion as in any that he gave to the Committee. In this, as in some other matters, it is probable that the opinion and advice of the consulting engineer were followed, instead of his own.

The written order, however, was distinct and imperative, to resume work on the heading at once, without waiting for pumps, or anything else.

Mr. Shanly appealed to the governor and council for a reversal of this order, and he has laid before you, and furnished to the attorney general, his memorandum, made at the time of the hearing on that occasion. It is as follows:—

"MARCH 14, 1872. *Central Shaft—West Heading Question.*—Hearing before governor and council to-day. Mr. Allen, as counsel with me, the hearing being to discuss the question of driving west heading as ordered by Frost's letter of 2d inst. Mr. Philbrick insisted that a second large pump should be put in, and I showed the utter impossibility of getting such a pump at work in time be of any service in advancing the completion of Tunnel, and that the putting of it in must inevitably retard the work eastward, on the progress of which the due and timely completion of the Tunnel really hinged. I also tried to convince the council that the forcing of the west heading, in the face of such threatening of more water, was to run the risk of being wholly driven out of the shaft, which, if once filled with water, would probably never again be pumped out. The driving of the heading, at all hazards, was, however, insisted on, water or no water; but the new pump question yielded. I also said, that, in order to drive the heading at all, it was absolutely necessary that it be dropped from top to bottom level, and driven on an upward slope from the starting-point below. That to accomplish this change would take till about 1st May. Agreed to.

" (Signed)

W. S."

The heading was accordingly dropped from the top to the bottom level, and in May, in an advance of only 17 feet, there was an increased flow of about 60 gallons per minute (not 100, as Mr. Philbrick said), which was more than sufficient for the capacity of the pumps. The mining was of course stopped, the hoisting of rock discontinued, the hoisting cages equipped with baling tanks; which, in the words of Mr. Frost, given in his report of May 24, 1872, was "the only present action consistent with reasonable security"; the regular flow being then, as stated in the same report, a little more than 205 gallons a minute. Preparations were also made for putting in new pumps of  $7\frac{1}{2}$  inches in diameter.

In this condition of things, an order in council was passed, June 14, 1873, as follows:—

"Whereas, upon a special report of Edward S. Philbrick, engineer on the Hoosac Tunnel, made upon the return for the month of May, 1872, that the Messrs. W. & F. Shanly, contractors, have not performed their contract in the progress of the work, the certificate, No. 19, which would otherwise be due, be withheld until further ordered."

This was sent to the Messrs. Shanly, with a letter saying that Mr. Philbrick had reported that *the progress of the work west of the central shaft was not satisfactory*; but offering to him an opportunity to be heard, if he desired it.

Upon this, Mr. Shanly made all his arrangements for abandoning the work, if, upon a hearing before the governor and council, the order should be insisted upon. He came to Boston, and his memoranda of the hearings, made at the time, have been laid before you, and furnished to the attorney general, and are as follows:—

"JUNE 20, 1872. *Council Meeting, Boston. Central Shaft.*—Went before the governor and council, by request, to explain reasons for having discontinued working west from central shaft. Stated that the increase of water was so great as to require our whole power of engines and pumps to keep it down; that it would require at least four months to erect new power; and that during that time but little work could be done eastward, as the hoisting machinery would be mostly engaged in assisting in getting in the new pumps; and also, if we continued to work east, as at present, we might reasonably expect to have the headings meet in six months, when no further



pumping would be necessary. Mr. Philbrick, who was present, admitted that it was now too late to think of new pumping machinery, and that it would be better for us to abandon west workings, keeping all the force east, so as to let the water off as soon as possible. He gave it as his opinion, however, that we could not finish the work within the time.

“The council will meet again on Friday, 28th inst., to hear our statement as to what we were doing and of the progress we think can be made, showing the very earliest time the work can be completed.

“ (Signed) ”

F. S.”

“JUNE 28, 1872. *Hearing before Council. Central Shaft Question.*—Had interview with governor and council on subject of central shaft and suspension of west heading work. Philbrick present. Had previously had a private interview with the governor, and explained to him the great risk of filling the shaft with water if the driving of west heading be persisted in; also stating that the filling of the shaft means the indefinite postponement of the completion of the Tunnel.

“Repeated same statement before council, and in answer to question from governor as to what progress we can make without driving westwards from shaft, I stated that the most we can promise from three headings would be what the contract requires from the four headings,—385 feet per month,—and that our progress henceforward till end of year would be from 370 to 385 feet per month; that we fully expect to be cut through between east end and central shaft by 31st December, and that beyond that time we hope to make from 250 to 280 feet per month on the two headings west of shaft. Stated the whole distance now to penetrate at about 5,300 feet, of which 1,400 was east and 3,900 west of centre. Also showed that to attempt to put in more pumping machinery would simply be to delay the eastward work, and that even then it would not be possible to get another pump into working order in time to be of any service.

“Mr. Philbrick ceased to urge the pump matter, and turned his arguments to show that, with the progress promised, the Tunnel could not be finished by 1st March, 1874. In figuring up the period for joining the easterly workings, he fixed the 15th January, instead of 31st December, as calculated by me, and said he considered that eight months after joining of headings would be required for completion of work east and west.

“After a full hearing of the matter, council decided to adopt my views, and allow us to proceed on the three headings, and without putting in other pumping machinery.

“ (Signed) ”

W. S.”

Mr. Philbrick's report of June 13, 1872, has also been laid before you, and no one can read it without the feeling *that he hardly thought it an even chance that the work could go on, even with a third pump, as large as the largest of those already in.*

Mr. Frost, also, in his report of June 10, 1872, said that "no advance westward can reasonably be undertaken unless further means for removal of the water *shall first be provided.*"

These matters have thus been detailed, in order that it may be seen how the prospect appeared at that time. And in this aspect it is entirely unimportant whether it afterwards proved that there was a largely increased influx of water or not. As Mr. Philbrick said in his report, the condition of the rock could not be ascertained before piercing it, and after piercing it it would be next to impossible to check the flow from the newly-cut seams. If new pumps should be put in, and should be overtaxed by new water, the mining would have to stop again.

This, then, was the situation. It was impossible to advance westward without new pumps. To provide new pumps would take several months. If provided, the chances were that they would be useless.

It so happened, however, that experience afterwards proved, as a matter of fact, that the fears of Mr. Philbrick and the conviction of Mr. Shanly were both well founded. The steady flow of water was greater than the capacity of two pumps of the largest size used or contemplated, and the occasional flow, for a day or two, was immense. Measurements were not taken regularly (so Mr. Shanly and Mr. Frost both say), but the testimony of Mr. Shanly to finding a large cavern of water on the 21st of June, 1873 (five months before joining the western headings), which yielded over 500 gallons per minute for a day or two, is explicit, he having made a memorandum of it at the time; and Mr. Frost's testimony is substantially to the same effect.

Mr. Shanly has also given a statement based on the actual progress made afterwards, which shows what would have been the progress of the work if his plan had not been interfered with. The opening east, which Mr. Philbrick, in his

report of June 13, 1872, thought could not be made before February 1, was actually effected on the 12th of December, and would have been in the early part of October. Drainage being thus obtained, the westward headings would have been joined early in September, 1873, or less than three months after the time contemplated in the contract, if regular rates of progress had been made.

The loss to the Messrs. Shanly in consequence of the order of November, 1871, is set forth in a detailed statement of items which has been submitted to you, and amounts to a little over \$217,000. This is exclusive of the cost of putting in the large pumps, which was just under \$56,000.

This result, so disastrous to themselves, and so injurious also to the Commonwealth, justifies them in the opinion which they have always entertained, that the mildest criticism that can be passed on the course pursued by the engineers is, that it was a gross blunder. Fortunate is it for the reputation of Massachusetts, as well as for its business interests, that a contractor was in charge of that work with intelligence enough to appreciate the situation, and nerve enough to withstand these engineers to their face. The Commonwealth was spared the last and crowning discredit of seeing the central shaft filled with water, from obedience to an official order which could not be understood otherwise than as an order to continue the westward workings, given in the face of an official report that the work could not be done.

#### UNREASONABLE REQUIREMENTS OF ENGINEERS.

In the next place, there has been a *strictness of construction* on the part of the engineers manifesting itself in respect to many different matters of detail, some of which, in his opinion, undoubtedly furnish to the Messrs. Shanly a just legal claim for compensation for extra work, and others have at least subjected them to unnecessary annoyance and expense without any benefit to the Commonwealth. Several illustrations may be given:—

*Trimming.*—One subject of question that has arisen between the contractors and the engineers, has been in respect to the trimming of the Tunnel. The Tunnel was to be made of a



certain prescribed size, and it was expected that the rock would be self-sustaining, and that there would be no water in any troublesome amount, so that the contractor might in working approach very closely to the prescribed size, without being obliged to excavate a greatly increased amount. The language of the specifications prepared and put out by the Commonwealth, and serving as the basis upon which all the bids of contractors were made, was as follows :—

*“As the rock is sufficiently hard to prevent apprehension from falls and slides, estimates will be made only of quantities within the exterior lines prescribed for the Tunnel.”* (Page 3.)

This is what the Commonwealth said before making this contract :—

On the 25th of April, 1868, General Haupt was applied to by eighty-three members of the legislature for information as to the best manner of completing the Tunnel. His reply to this communication has, therefore, a character almost official. In giving the terms and conditions on which a contract might be made, he says :—

*“The manner of finishing the Tunnel should be accurately prescribed in the contract, so as to prevent unreasonable exactions from the contractor. An engineer could absorb any profit, however large, by requiring excessive trimming. . . . As a Tunnel through such a rock as that of the Hoosac must necessarily be rough, and cannot be made to conform exactly to any prescribed dimensions, the amount of inequality that will be admissible should be distinctly recognized in the contract, and great care should be observed to leave no room for misunderstanding, for the courts afford no means of redress to the contractor if differences should arise, although they are open to the State.”* (Page 15.)

Unfortunately for Mr. Shanly, he had not seen this caution of General Haupt before making his contract; and if he had seen it, he would have been slow to believe that in practice engineers would put so extremely literal a construction upon the words of a contract as has been done in this case. He made the mistake of supposing that his contract to excavate a Tunnel of a prescribed height and width, and according to a prescribed section, would be satisfied if he should excavate a



Tunnel which on the whole, in all its parts, should be substantially larger than the area of the section prescribed, even although a minute examination might detect occasionally points of rock projecting an inch or more in portions of the section where no injury could arise from them. This was a grand mistake. Such was not the spirit or the construction of the engineers. The contractors had undertaken to make a Tunnel of a certain size and section. No matter how large the general excavation might be. The contract, they say, is not complied with, unless there is a literal compliance down to the minutest measurement. There has been, they say, an increase in the size of grain cars since this contract was made, and, therefore, it was perhaps considered just that the contractors must submit to a construction that otherwise would have been monstrous. That no injustice may be done to anybody, Mr. Philbrick's own words of July 13, 1872, shall be given :—

“We can't, with safety, allow them [the new grain-cars] to pass through the Tunnel, unless *every inch* of the established form is excavated. Mr. Shanly says, and Mr. Frost admits, that the former has complied with all the latter's directions in regard to trimming. This seems to indicate a lack of *directions*; and, in conversing with Mr. Frost, I am sorry to say, that he does not appear to appreciate, as I do, the importance of urging the contractors at once, and persistently, in this particular.”

To the common mind, neither the need nor the justice of so rigid a construction was perceptible; and, accordingly, it is not strange that Mr. Frost did not appreciate the importance of it, nor is it probable that he, alone, would have adopted it. But Mr. Philbrick's counsels prevailed, and were executed in this wise: frames, or forms, were constructed, the inner lines of which were of the exact section prescribed for the Tunnel, and placed at distances, usually of twenty-five feet apart, and observations were taken with candles, and literally *every projecting inch* was marked, and was actually removed by the Messrs. Shanly, even on the very roof of the Tunnel. For this purpose, new scaffolds had to be erected and new blasting done. The whole Tunnel was gone over in this way, and was, in effect, sand-papered down to such a degree of smooth-

ness that there was no projecting inch within the lines of section prescribed in any part of the Tunnel. The contract required it, as was supposed, and a precise fulfilment was exacted, by withholding large sums of money till it was done,—down to the last inch. In this way, an amount of detailed trimming was got out of Mr. Shanly, that subjected him to an expense of \$110,000.

You thus see that these engineers were faithful and strict, in getting out of Mr. Shanly every particle of work that a strict construction of his contract could be made to include. Having done this, he naturally supposed that he had fulfilled his duty as to the excavation of rock.

*Taking down loose rock.*—He was mistaken. The Tunnel must be gone through with once more. The engineers then proceeded to examine and see if there was not some more rock that ought to come down. The rock was not of that character that had been described in the specifications which had been issued to Messrs. Shanly. These specifications had declared, in effect, that as the rock would be self-sustaining, no apprehensions were felt from falls or slides, and therefore no estimates would be made or allowed for any excavations outside of the exterior lines prescribed for the Tunnel, because the contractor would not be called on to make any such excavations. But now it was found that the rock in certain long spaces was *not* self-sustaining, and apprehensions *were* felt from falls and slides, and it *was* necessary to make excavations outside of the exterior lines of the Tunnel. Who should be held responsible for this changed state of things? Nobody is here to deny that the Tunnel should be made safe. This should be done, of course, no matter how much rock is to come down. But the question is, whether this work, now found necessary, but which the Commonwealth at the outset said, in express terms, would not be necessary, and therefore should not be paid for, shall be done at the cost and expense of the Messrs. Shanly. Your attention has been called to the language of the specifications upon which the bids were made. Now, please attend to the language of the contract itself. The contract says,—

“The *size* and general description of the work,” and other particulars, “are set forth in the schedule hereunto appended, which constitutes a part of this agreement.” (Page 1.)

“The engineer or engineers of the Commonwealth shall give the lines and grades of the Tunnel, and the lines of the central shaft, and be responsible therefor.” (Page 2.)

The size of the Tunnel is to be as follows :—

“In rock, without arch, 24 feet wide in the clear ; 20 feet high in the clear,” and larger where arching is required. (Page 6.)

There are repeated references to “full-size Tunnel,” “full-size section of Tunnel,” etc., meaning the size just mentioned. The estimated amounts are all based on a Tunnel of the size mentioned.

The contract then says,—

“Estimates will be made only of quantities *within the exterior lines* prescribed for the Tunnel.” (Page 7.)

“Any material DETACHED by blasting or otherwise, outside of said lines, must be removed by the contractors without charge.” (Page 8.)

The contractors are only bound to remove what is *detached*; and detached means “severed, disjoined, separated, disengaged, parted from.” It does not mean *loosened*.

As if to show still more precisely what was meant, the contract recurs to this subject further on, and says,—

“Estimates will be based upon quantity of material which lies within the line of section prescribed by the engineer or engineers ; and any material FALLING from outside of these lines, whether *detached* by blasts or falls, must be removed by the contractor without charge.” (Page 10.)

That shows what the contractors are to remove *without charge*. It is such rock as is detached, and falls. If they are called upon and compelled to go outside of the exterior lines prescribed for the Tunnel, and take down rock which is *loose*, but which nevertheless stands, and to remove it from the Tunnel after they have taken it down, the question is, whether this also shall be done *without charge*. Is it not plain that the express mention in the contract of the duty of

removing without charge material which is detached and falls from outside those lines, conveys by direct implication the idea that material which is not detached, and does not fall, but has to be taken down by blasting or otherwise, and then removed, will form a proper subject of charge as for extra work,—work not contemplated in the contract?

Can any argument make it plainer? It rests on the same ground that was last year recognized by the legislature in respect to the duty of laying a brick arch. The contract provides that the contractors should lay bricks to an amount not exceeding 4,500,000. The argument against the contractors was, that they must lay all the arch that might be found necessary, even if it were the whole length of the Tunnel, and the cost were to be reckoned by millions; and they were accordingly called upon to lay a long distance, after the 4,500,000 brick had been used. They resisted this call, and came to the legislature, and the legislature did not insist upon that construction of the contract. Now, what was the ground taken by the engineers? They said, the contractors were bound to do everything that was required to be done, in order to leave the Tunnel ready for use, be the same more or less; no matter what may be found necessary, the contractors must do it, and the attorney general declares before you that he relies on the same ground now. But the contract, in its true construction, requires nothing of the sort. Mr. Bartlett gave a legal opinion to this effect last winter, which was published. The contractors undertake "to do and perform all the work necessary to complete the Hoosac Tunnel, *in accordance with the schedule hereunto appended.*" (Page 1.) And the clause at the conclusion of the schedule holds them to "the full and complete performance of the entire work of the completion of the Hoosac Tunnel *to be performed under this contract.*"

Take those two general provisions, with which the contract opens and closes, and examine them in connection with the other parts of the contract, and you will see that these contractors, upon a just and fair construction of the language used, do not bind themselves so far, that, being allowed to estimate only for laying 4,500,000 of brick, they must go on and arch the Tunnel from one end to the other if safety shall



be found to require that to be done, and at a cost of \$2,000,000 to \$2,500,000, as the attorney general contends; nor so far that, being allowed to estimate only for excavating rock within a certain area, and for removing what shall be detached and falls, they must go on and take down and remove a large amount outside of that area, if safety shall be found to require this to be done. Such a contract would be a one-sided one. The advantage would all be on the part of the Commonwealth. The legislature of last year, without going nicely into the legal question, did not insist upon such a construction. They gave it up, and assumed the extra arching themselves. The same principle is applicable now.

It may well be contended that it is plain, as a matter of law, that the Commonwealth has no right to insist upon such a construction, and one might appeal with great confidence to the legislature on this ground alone. But it is also submitted to the practical judgment of every intelligent man, that even if the strict rule of law were otherwise, these contractors might fairly consider that this work was outside of their duty; that business men generally would so consider it; and that if the matter be merely questionable, the legislature would not wish to force contractors, in a doubtful matter, to submit to an adverse decision, with no right of appeal.

The correspondence shows that the requirement of the engineers was that the contractors should remove from the roof and sides the slightly loosened slabs or masses, which, not threatening any danger in the present use of the Tunnel, would evidently impair the measure of probable security which belongs to entire completion; and this duty, so required, involved the necessity of further blasting. These are the words of Mr. Frost, in a letter which was referred to.

The correspondence is long, and shows clearly the explicit orders for the work, the remonstrances and protests from the contractors, their final performance of the work under protest, and the subsequent recognition of it as extra work to the extent of \$5,000, which was paid. The amount unpaid is about \$22,000, and Mr. Frost, who has examined the items, candidly admits that this fairly represents the cost of the work, and there is no question as to the amount.

Indeed, it would be doing injustice to Mr. Frost not to say, that in respect to the details of all of these items, after full and critical examination, he declares, without evasion or criticism, his approval of them all.

*Enlarging Tunnel 810 feet from East Portal.*—The contract says, in referring to the east section, "a portion of which has been enlarged to the full height of 20 feet and the width of 24 feet, as proposed." It thus appears, by the contract itself, that the Tunnel had been made of full size for some distance. How much? The distance is fixed by official documents beyond dispute.

The Commissioners' report, House Doc., 1869, No. 192, p. 28, in the paragraph which was omitted or suppressed in reprinting that report last year, says: "At the east end the distance excavated is 5,282 feet, and the *Tunnel is of full size from its portal to a point 810 feet west.*"

Mr. Frost's report, appended to that of the Commissioners, says: "The Tunnel *has been opened out to full size during the past year for a distance of 810 feet from east portal.*" (Page 58.) And again, on page 67, he says; "Of the first half mile of this distance [at the east end] *a length of 810 feet is entirely completed.*" This work was done under Mr. Frost's own superintendence, and at the commencement of the Messrs. Shanly's work, as he admits himself; and while these matters were fresh in mind, he furnished them with a set of diagrams showing what work they were to do, and these diagrams began at a point 800 or 810 feet west from the east portal, and Mr. Shanly says he gave oral assurances to the same effect.

Under this state of things, the Messrs. Shanly might reasonably suppose that they had no work of excavation to do for the first 810 feet. But they were again mistaken. Notwithstanding the express language of the contract that a portion had been made of full height and width; notwithstanding Mr. Frost's official statements that the Tunnel had been *entirely completed* for this 810 feet; notwithstanding the approval of the Commissioners of that part of the work as a substantial completion within the just meaning of the contract; notwithstanding the diagrams; the engineers, finding upon applying their careful scrutiny that there were a few

points of projecting rock in that portion of the Tunnel also, sought to strain the contract so as to get the work of removing those points done for nothing.

Now, this was a most disreputable piece of business, such as no man in his private transactions could do, hoping to maintain his credit as a just man. But what was, in fact, done? March 22, 1871, Mr. Frost ordered the Messrs. Shanly to commence the work of Tunnel enlargement *from the portal*. May 6, he repeats this order with a threat of withdrawing sums from the estimates. May 8, the Messrs. Shanly reply, saying:—

“East end, from the portal for 800 feet, we hold that we have no work to do till we come to lay the track, that part of the Tunnel having been handed over to us as finished work.”

Mr. Frost's reply, May 17, peremptorily ordered him to proceed with the work “in the east end of the Tunnel, *commencing with the portal*,” and saying a set of frames would be furnished for his use. As Mr. Shanly still did not recognize his duty to do this work, Mr. Frost, on the 5th of August, 1871, writes to him as follows:—

“In your letter of 8th May, you set forward the claim that, from portal at east end for 800 feet in, you have no work to do, ‘that part of the Tunnel having been handed over to us as finished work.’ *I have not any such understanding*, and the record and memoranda in my office would seem to show very clearly that your work commences *at the east portal of the Tunnel*. The contract mentions about 860 feet at the west end of the Tunnel as already completed by B. N. Farren, forming part of the 931 feet which was reserved only your contract as to excavation and brick-work. It is very desirable to have the fullest understanding as to such points. I will suggest the possibility of your having had in mind, at moment of writing, the sentence above quoted, without distinctly recalling its context.”

The Messrs. Shanly replied, August 7, reiterating their views, consented to do the work, but saying, “we must hold that in equity we are entitled to be paid for it *extra* to the contract.” The cost of the work was \$3,582.

Now, when it is remembered that Mr. Frost was speaking of work done under his own superintendence, and pronounced



entirely completed by himself in an official report, the imagination runs wild in endeavoring to understand what he was thinking of in writing that letter. Would any one of you, without the evidence before you of documents made at the time, suppose it *possible* for an engineer of the Commonwealth, intrusted with the superintendence of a great work, to put himself into so ridiculous a situation as that? But that is not the worst of it. The governor and council, who in the hurry of their concluding days of official service could not have time to examine these matters minutely, and who, very likely, on referring to the reprint of the Commissioners' report, were misled by the suppression of that important paragraph (which suppression is not yet explained), have been allowed to take a position which it would seem that they could not have taken if aware of the actual facts. Mr. Frost thinks he informed them fully. But it is not to be supposed that they would have rejected this item; if they had understood the matter as you do now. Nor will the legislature readily adopt the view urged by the attorney general that no matter if the State did represent, in the schedule appended to the contract, that a part of the Tunnel was already done, yet they are not bound by it, and the contractors must, nevertheless, be held to do the work without compensation. No one of you would take such ground as that in a private transaction.

*Grading Embankments at East End.*—The contract says :

“The material removed from the Tunnel, at both ends thereof, will be *deposited* wherever the Commonwealth, by its officers in charge of the work, shall direct, . . . and the contractors shall not be required to haul the same more than 3,000 feet from either end of the Tunnel.”

The contractors were to *haul* and *deposit* this material. But the Commonwealth wished to build a railroad track, and also a county road, within 3,000 feet from the east end of the Tunnel, and so the engineers thought they could compel the contractors, not only to haul and deposit the material, *but also to grade the embankments.*

Mr. Frost was asked the direct question what his directions to Mr. Shanly were, and he testifies explicitly that his direc-



tions were "to build the railroad bank," and "to build the highway"; and that the charge was for handling the rock after it was deposited.

What is reasonably implied, as the duty of the contractors, from the obligation to *haul* and *deposit* this material? You are to remember this is a work that was going on day and night; there was no cessation in the motion of these cars, except when stopped by flood or other disaster. The question is, whether the contractors were bound to *handle over the rock* after dumping it; to leave it at an accurate grade; or whether their duty was discharged by hauling out the rock and depositing it where it would be available for use by the Commonwealth, for the purposes required.

The work which the Messrs. Shanly undertook to do was the *construction of the Hoosac Tunnel*. The hauling and depositing of rock required by them was simply incidental to their work *in the Tunnel*. They did *not* undertake, in whole or in part, to build a railroad or a county road, outside of the Tunnel. No contractor upon reading the contract of the Messrs. Shanly could fairly be held to understand that he could be called upon to deposit this rock material at so accurate a grade, according to stakes set, as to serve, without further handling, as an embankment for a road.

The correspondence shows that this work was done under a protest from the Messrs. Shanly, that it was outside of their contract, and would be regarded by them as extra work. [See letters from the Messrs. Shanly of June 27 and August 8, 1873, to Mr. Frost; and Mr. Frost's letters of August 7, September 12, 18 and 26, 1873.]

Mr. Frost, in his testimony, goes on to say that \$600 was allowed to the Messrs. Shanly for work in grading which was done before he had charge of that part of the work, and that no allowance was made for any work done under his superintendence. The memorandum of the decision of the governor and council shows the same fact. Now, here is found another illustration of the whimsicalities of this eccentric engineer. From the fact that this matter was presented to the governor and council, and disallowed, in terms implying that no extra work was done except during the time of his predecessor, you would naturally infer that it was not recognized that any

such extra work was done. But, on the contrary, Mr. Frost's letter of August 7, 1873, Mr. Shanly's reply of August 8, and Mr. Frost's second letter of September 12, expressly recognize and stipulate that a portion of this work *is outside of the contract*, and to be paid for extra; and in the last letter Mr. Frost says,—

“As to the additional work which I recognize to be outside of your contract, I shall propose to compensate you in the same manner with other claimants for current account, *by a special voucher for the amount, to be paid as soon as the work is completed.*”

And the amount per cubic yard is fixed.

Now, this was in 1873, and the very last of this work was finished in April, 1874; and yet the Messrs. Shanly wait for their pay till this hour. Their claim is rejected by the governor and council, with the declaration that the engineers have advised them that nothing was due; and they are here informed by this agent of the Commonwealth, that if they will withdraw this item from their petition to the legislature, and apply to him at North Adams, he will be ready, in the course of a week, to furnish a voucher or payment for so much as he recognizes to be work outside of their contract! This is a very good illustration of the methods of doing business, and which the Messrs. Shanly have been subjected for over five years.

The cost of this work was \$3,511; a part incurred by injury to their rolling-stock in being forced to go down too steep a grade, in the work upon the highway. This element of injury is recognized by the engineers.

*Central Drain.*—When the Shanly contract was executed, 5,017 feet of central drain from the east portal were supposed to be finished. The contract shows that the eastern division was 10,617 feet in length, and 5,600 feet of central drain were specified as to be made, leaving 5,017 feet supposed to be already finished. Mr. Frost admits this; according to his own report, 2,256 feet were excavated in 1868. (House Doc., 1869, No. 192, p. 65.) He admits that this was done under his own superintendence, as engineer; and covered up with timber, as completed, and the loose rock and debris allowed

to accumulate, so that no one could examine it, even if so disposed. The final covering of this with stone, would be one of the last pieces of work to be done in the Tunnel.

In point of fact, it turned out that of this 5,017 feet of central drain supposed to be finished, 4,816 feet had not been brought down to grade, and 201 feet had not been touched.

This happened, as Mr. Frost testifies, through the carelessness of his subordinates, and it was not detected by himself, and the imperfection was first brought to light by the letter of Messrs. Shanly of August 7, 1874, to Mr. Frost, as follows :

“ As far as we have yet uncovered the central drain east of 4,800 eastern section, we find it all too high in the bottom ; so much too high as to require a great deal of labor to bring it to the proper grade, and it will take all the force we now have at east end to complete it ready for the drain-pipe, by latter part of this month,—that is, provided it all proves to be as much above ‘ grade ’ as what we have already uncovered. This work, being outside of our contract, we shall charge as ‘ extra ’ to the State.”

Mr. Frost's reply of August 13, says,—

“ *I recognize that your understanding, and my belief also, at time of making your contract, regarded this length of trench as having been excavated to the proper grade. I am not, however, authorized to entertain and decide equitable considerations.*”

And he suggests that the Messrs. Shanly should transmit to him a statement of the cost each month.

Thus it appears that the agent of the Commonwealth, before the Shanly contract was made, did this work, in part imperfectly, and in part not at all,—*concealed the imperfection in part by covering it with timber, and in part by allowing loose rock and debris to accumulate upon it, so that it was not open to examination ; and then represented the work as complete*,—so that the Messrs. Shanly entered into this contract upon the strength of those representations. Discovering the imperfection five and a half years afterward, they have done the work themselves, giving notice that it was outside of their contract. The engineer assented ; but to this day no allowance has been made for the \$8,700 which they expended in doing it.

Now it is argued here by the attorney general that, nevertheless, the Messrs. Shanly, though thus misled, took their own risk of the drain's having been completed. This argument scarcely differs from an argument that the State might take advantage of its own fraud. So far as the Messrs. Shanly are concerned, the transaction, in its effect, was the same as a direct fraud. Mr. Frost concealed the imperfection in the work done under his own superintendence, and then represented to them that the work was complete, and they were misled and deceived thereby. If he knew of the imperfection, this was a gross fraud. If he did not know of it, it was gross negligence. It is not intended, of course, to charge upon Mr. Frost that he was guilty of an intentional fraud; but he only escapes from the imputation of a gross fraud, by asserting his own gross negligence, and the effect on the Shanlys is the same. And yet it is argued here that this was a fair risk assumed by them. The Commonwealth of Massachusetts cannot afford to take that position.

This is a sample of the kind of construction of their contract to which they have been obliged to submit for years, and is a good illustration of the wonderful and mysterious engineering that has characterized the superintendence of the whole work.

These various matters serve to show the kind of requirements that have been made by the engineers upon the Messrs. Shanly, and the spirit in which they have been met. There has never been an instance when the Commonwealth has had work necessary to be done, but outside of the contract, where the Messrs. Shanly have refused or hesitated or haggled for sharp terms. Suppose they had taken the example of the engineers for a guide, and said, "There is our contract; we will do that, and *we will do nothing else.*" Such was not their course. They have shown the most entire good faith to the State, under all emergencies and oppressions and embarrassments, financial and otherwise; repairing storm damages in advance even of any request to do it; willing to undertake extra work, with no provision made in advance for payment; but relying with a confidence, that even the conduct of these engineers has not wholly removed, in the ultimate good faith and justice of the Commonwealth. They appeal



from the agents of the State to the State itself, and expect from you that justice which they have not hitherto received.

#### MISTAKE IN ORIGINAL MEASUREMENT.

Again, it is now a conceded fact that there was an error in the computation of the amount of solid rock excavation per running foot of Tunnel, by which Mr. Shanly was misled at the time of making his contract. This computation had been made by an assistant of Mr. Frost's, who thought that the amount to be excavated, for an area of the size prescribed for the Tunnel, would be  $\frac{22}{1000}$  of a cubic yard less than it really was, for each running foot.

Mr. Frost frankly concedes this error, and admits that the cost of this additional excavation would amount in all to \$22,000, at contract rates. Mr. Shanly entered into this contract relying implicitly on Mr. Frost's figures. Everybody agrees that he accepted them as accurate. This is a matter of absolute injury to the Messrs. Shanly. They were misled and deceived, though not intentionally. *By this blunder, the price they got for the Tunnel is \$22,000 less than it otherwise would have been.* The contract price was arrived at by adding up Mr. Frost's various items; \$22,000 more would have been included but for this blunder in a matter of pure mathematics. *Mr. Shanly has lost this amount outright. If the truth had been told to him, he would have had it.* The contract price would have been just so much more.

Without disputing this,—for it is indisputable,—it is said that in the western section, where arching was expected to be done, a smaller number of cubic yards was in fact excavated than Mr. Frost estimated at the outset, and this, it is supposed, in some way furnishes a reason why Mr. Shanly has now no ground of complaint. But the argument is an unjust one.

In the first place, the fact is not satisfactorily established; it was not brought up before the governor and council; it was never intimated till near the conclusion of the hearings; no details were given making verification possible, and it was, as it were, sprung upon us, after Mr. Frost had written Mr. Shanly a letter, dated March 8, 1875, telling him his item of \$22,000 needed no change.

In the second place, there is no question that excavation was made sufficient to receive 4,500,000 brick laid in arch. How much excavation would be required for this was known to be a matter of *estimate*, not of exact *computation*. The amount would depend upon the thickness of the arch required, and this could not be known beforehand. If, therefore, the actual excavation required should prove more than the estimate, Messrs. Shanly must nevertheless take out the rock; if less, they were entitled to the advantage. The contract price was not to be varied by the result of a conjectural estimate; but if the contractors are to suffer from the effect of an erroneous computation in pure mathematics, in a matter wherein they were confessedly forced to rely implicitly on the statement of the engineer of the Commonwealth, it has all the effect of a positive fraud.

In the third place, Mr. Frost tells you that in fact, according to the best judgment he can form upon a detailed examination of the rock, the Messrs. Shanly have actually excavated 22,638 cubic yards of rock outside of the prescribed section of the Tunnel, in those 8,573 running feet which three of the experts, employed by the corporators, have agreed upon as likely to require arching; and that *if this space should be arched, according to the recommendation of the three concurring experts, the value of this extra excavation to the State, at contract rates, will be \$250,000*. It is not, therefore, for the State to say that the Messrs. Shanly have done less work than was estimated at the outset, when in only 8,573 running feet they have made an excavation, necessary for the State now, of 22,638 cubic yards outside of the prescribed lines; showing that in the whole Tunnel they have probably exceeded the assumed quantities, in their actual excavation, by as much as 50,000 cubic yards! *Shall the State avail itself of this \$250,000 worth of necessary work, outside of the contract, without paying for it, and send the Shanlys home with a loss of \$225,000?*

#### THE DESTRUCTION OF THE HAUPT TUNNEL

Caused loss by *increasing the working expenses \$2,700*, and by delaying the completion of the Tunnel.

The necessity of the Haupt Tunnel to give an exit west,

was recognized in the contract, and an allowance of \$8,500 made for clearing out and timbering it. To understand this clearly requires some acquaintance with the situation of the ground at the west portal of the Hoosac Tunnel. Just to the west of that portal there is a hill, through which the Haupt Tunnel was built. An open cut for the railroad has now been made through that hill, but, at the time when the Shanly contract was entered into, there was no way of delivering the material from the west end of the Hoosac Tunnel except through the Haupt Tunnel. It was not only the duty of the Messrs. Shanly to keep the Haupt Tunnel open, but it was their plain right to have free egress through it from the west end of the Hoosac Tunnel, until the completion of the work under their contract.

The railroad from the west portal of the Tunnel was to be built by other contractors,—Messrs. McClallan, Son & Walker,—whose work in August, 1873, began to interfere with the maintenance of the Haupt Tunnel by the Messrs. Shanly. On the 28th of August, 1873, the Messrs. Shanly sent to Mr. Frost the following letter, a copy of which was sent to the governor:—

NORTH ADAMS, 28th August, 1873.

DEAR SIR:—We have to notify you that unless the work now doing under the state contract with Messrs. McClallan, Son & Walker, in the deep cutting approaching the western portal, be suspended at once, we will not hold ourselves responsible for the maintenance of the Haupt Tunnel.

As the case now stands, it may be said that while we, under our contract, are bound to keep up the old Tunnel, a contract has been made with other parties to batter it down.

The action of Mr. Dwyer's steam-excavator, which has stripped the outer covering from off the south side of the Tunnel for about half its length, causes the supporting timbers inside to shake and vibrate to such an extent that they must inevitably, and before long, give way, and so cause the Tunnel to close in, while his blasting operations will certainly complete the ruin. A single blast *outside* yesterday, brought down several carloads of rock *inside*, obstructing the passage through.

The Haupt Tunnel has by us been maintained in perfectly safe condition for all purposes contemplated by or required under our contract, but we cannot undertake to protect it against the batter-

ing-rams and artillery now assailing it from without. The stripping of one side, while the other is left fully loaded, would be sufficient to overbalance the very best constructed arch.

We warn you that the destruction of the Haupt Tunnel, now imminent, will cause us great damage, and seriously impede the progress of the main Tunnel.

This is a matter of so great moment that we deem it advisable to send a copy of this communication to His Excellency the governor.

Yours truly,

(Signed) F. SHANLY & CO.

BENJ. D. FROST, Esq., *Engineer, etc.*

On the 30th of August, Frost sends a reply containing the following :—

“The incident which you mention occurred from the jar of an unusually heavy blast, but it showed the limits of safe proximity to have been reached. I therefore directed J. W. Dwyer, who is making the approach cut for McClallan & Co., to withdraw his steam-shovel to the point 700 feet distant, at which he will commence to bring up the lower (grade) breast of the cut.”

The matter then rested for a time, till on February 4, 1874, the Messrs. Shanly addressed Frost as follows :—

“We must again draw your attention to the condition of the Haupt Tunnel, which has never been safe, and not for two consecutive days even passable, since the heavy fall of rock which took place on the 4th of January. We have been entirely cut off from access to our excavation from façade and put to much loss both of time and money, and must again record our sense of the injustice and injury done us in not being allowed to complete the façade and arch last summer.”

Frost's reply, February 11, was very long. Among many other things, it contains the following :—

“Unavoidably, your excavation has been much hindered by the successive interruptions of route of haulage of materials.” . . .

“A week later [*i. e.*, after Jan. 13], finding the prevalent mild weather was occasioning falls from slopes, and other incidents of unavoidable danger, I became convinced that new arrangements



must be made in order to secure the concurrent progress of the railroad and façade excavation.” . . .

“At the immediate present, it is not reasonably possible to maintain safe passage through the whole length of the Haupt Tunnel. I have already made provision for the important matter of drainage through it, *and must, of course, deem the State henceforward responsible* for the maintenance of its construction. . . . Whenever you shall conclude to resume the excavation with your own force, or whenever you shall desire to transport any other material through the Haupt Tunnel, it seems to me that you should present to me, as the agent for the State, the option of re-opening the Haupt Tunnel for your transportation, or of allowance to you for the increased cost of moving your excavation or other materials by other route.”

On February 16, the Messrs. Shanly reply to him, thus:—

“Referring to your letter of 11th inst. about the Haupt Tunnel, we, of course, have no further responsibility for it, but still must hold the Commonwealth responsible to us for the damage and inconvenience we have been, and still may be, put to, by being deprived of access through it to our works. Our sub-contractors, too, may look to us to make good any loss or inconvenience they may be put to through the same cause.”

March 6, 1874, the Messrs. Shanly again write as follows:—

. . . “As we hold, that the passage through the Tunnel is no longer safe, and that large masses of the roof may come down at any moment, to the endangering of human life, if we continue to run our excavation out through the Tunnel, we have decided to erect derricks and other appliances for hoisting the material to surface-level.”

And asking him to indicate where the material may be disposed of.

Mr. Frost replied, March 7, saying,—

“Recognizing that the continuous maintenance of the Haupt Tunnel, so as to allow you transportation through it for removal of material excavated, must, before long, become a matter of considerable difficulty and expense, and also appreciating the consideration of greater safety in the alterations now proposed, I am glad to learn

your present conclusion to resort to hoisting direct to the surface-level by steam."

After this correspondence, in which Mr. Frost recognized the responsibility of the State for the interference with the Messrs. Shanly's work, and the annoyance and expense to them, time passed on until August, and no means of exit at the west end were furnished,—the Haupt Tunnel was destroyed,—the material had to be hoisted up through the west shaft; and, so long as the shaft was used for hoisting, the large amount of rock still to be excavated near the bottom of that shaft, must remain untouched. That work could not be done till egress was furnished at the west end, for blasting and hoisting could not go on together. Accordingly, August 26, 1874, the Messrs. Shanly wrote to Mr. Frost, as follows:—

"When may we count on having a track laid to the west portal, that we may run our cars out to the dumping-ground, and so enable us to complete the arch within the Tunnel? The want of our track through the Haupt Tunnel has caused us great delay, and is now adding largely to our expenses, and the time has arrived when we must have corresponding ingress and egress provided for us."

September 4, Mr. Frost replies, recognizing the increased expense to Shanly by reason of the closing of the Haupt Tunnel, in these words:—

"It is expected that the ballasting of the northern side of the west approach cutting will be finished by Wednesday next, and you can then proceed to extend, with suitable curves, from end of one of your present tracks,—say 100 feet west of the west portal," etc. "So soon as you shall have laid your short, necessary lengths of track and third rail, you will please furnish me a statement of the cost. *It is evidently one which you could have avoided, if continuous use of the Haupt Tunnel had been left to you.*"

September 16, 1874, the Messrs. Shanly again write to Mr. Frost, as follows:—

"We are greatly delayed in completing the excavation around west shaft, and all other finishing in west-end section in fact, by want of free access from west portal, immediately outside of which

Mr. Dwyer (sub-contractor for McClallan & Co.) still occupies the ground and blocks the track so as to render our sending out our cars with any degree of regularity not practicable. We wish to learn when we can be accommodated with free access to the dumping-ground, in order to allow of our arranging for closing the shaft."

Mr. Frost, in his testimony, concedes that the use of the Haupt Tunnel was necessary for them to finish their work in the west end of the main Tunnel; that the work must all be done up the west shaft till exit was possible through the west portal; that the work remaining to be done near the west shaft could not be done until that shaft was closed and exit obtained through the portal; that the State were forced to cut off that exit till September, 1874; and that Mr. Shanly was delayed in his work in consequence. It was a plain invasion of the Messrs. Shanly's rights, subjecting them, not only to the extra working expenses, but also, and more important by far, to the damage resulting from delay. Upon Mr. Frost's own statement—upon facts not here in any controversy at all—this loss is manifest.

It is now argued, that although it is just to allow to the Messrs. Shanly the damages sustained by them to March 1, 1874, yet nothing should be allowed for the damages during the time for which the contract was extended. This argument is, in substance, that the Commonwealth, while extending the time for good reasons, might, nevertheless, prevent the contractors from doing the work within that time. The attorney general fails to appreciate the ground on which this matter rests. It is this: the Commonwealth for a long time prevented the contractors from using an exit through the west end of the Tunnel. So long as the contractors were so prevented, they *could not* finish the Tunnel, and the delay was the fault of the Commonwealth.

#### LOSSES OF INTEREST.

Mr. Shanly has shown that, but for the delay thus imposed upon him, the use of the west shaft would have been abandoned in April, 1874; his whole work would have been finished by September 1, 1874, and he would have been entitled to a settlement on that day. Had a settlement been then made, and they been paid the amount in full which they had then

earned, they would have received in money \$548,164. The interest on this sum from September 1 till December 22 (which was the day of the actual settlement), making proper allowances for sums actually paid between those dates, would amount to \$10,603.

By the Resolve of 1873, chap. 48, it was provided that \$350,000 should be reserved and retained in the treasury until the completion of the contract, and, subject to said reservation, "the full amounts already earned or hereafter to be earned by the Messrs. Shanly shall be paid over to them." This Resolve has not been fairly carried out according to its true spirit, as appears from the fact that when the final settlement was made with them, \$456,000 which had been kept back till then, was paid, instead of \$350,000; and the sum of \$60,000 in excess of their earnings for the month had been paid to them in a recent estimate. The Messrs. Shanly put these losses of interest at \$19,850, according to a detailed statement which has been laid before you.

The Messrs. Shanly have also lost interest on the amounts of all those items for which payment should have been made to them heretofore; for example, the sum due for the work on the first 810 feet, at the east portal; for the grading of the embankments; for the central drain; for the storm damages at the west end; and for taking down the loose rock.

#### MONEYS WRONGFULLY WITHHELD FROM CONTRACTORS.

There is another kindred source of injury to the Messrs. Shanly, founded in a manifest and very oppressive injustice. Their performance of the contract was secured by \$500,000 of money earned by them, which was retained by the Commonwealth. Till their earnings reached this sum they received nothing. And after their earnings reached this sum, there was never a time when the State had not at least \$500,000 of their earnings in its treasury, until after the passage of the Resolve of 1873, directing that thereafter only \$350,000 should be retained, and even this was to a considerable extent nullified by the construction of the engineers, as has been shown.

This retention of money was the security provided in the



contract itself, and it was the sufficient and *only* security which the contractors were bound to furnish, or the State was at liberty to exact. It was withheld as *security*; and it was the security agreed upon as sufficient and satisfactory. If the contractors failed to observe the provisions of the contract, the remedy was, for the State, if it saw fit, to give them three months' notice, and put an end to the contract. But if this was not done, the contractors were entitled to be paid for their work, subject to the retention of the amount agreed upon for security. But the engineers enforced against the Messrs. Shanly another and additional security, not provided for in the contract, and wholly unjustifiable and illegal. They withheld in their estimates, at various times, large sums of money, which had been earned, as a sentence or punishment on the Messrs. Shanly for failure to observe directions or requests of the engineers as to methods and times of doing certain details of the work. For instance, Mr. Frost tells you that thousands and thousands of dollars were withheld on account of an omission to do certain matters of trimming, at the times when the engineers wished. They would not allow the Messrs. Shanly to select their own times for doing this work. Simply for a failure to do it at the particular times required by the engineers, this deduction was made.

The strictness of construction of the engineers seemed to increase with the difficulties of the contractors. In that dark season of 1872, in July, when work was necessarily suspended west from the central shaft, and was prosecuted to the east under the difficulties that have been described, the order came to trim off *every inch* of projecting rock without delay.

At one time \$27,000 was withheld from Mr. Shanly on account of trimming. The \$500,000 security was designed to cover all such matters as this. Other reservations of money were also made. It was oppressive and harsh and illegal.

#### INTEREST PAID BY CONTRACTORS.

All reservations of money, as well as all increased expenses of working, had also the direct effect to swell the

amount of interest paid by the Messrs. Shanly, so that in the aggregate it reached an amount quite beyond the original expectation. Including the \$500,000 retained by the State, the capital required for the prosecution of the work would not fall far short of \$700,000, the interest on which, at seven per cent., would be about \$50,000 a year. Following close upon the water difficulties of 1872, came the financial panic of that year, culminating in its memorable Black Friday, and forcing strongest houses to the payment of unusual rates of interest. The following year another season of financial embarrassment succeeded, which tested in the severest manner the strength of all who were carrying on enterprises which involved the necessity of large capital. In addition to the work required by the contract, the State, from time to time, were calling upon the Messrs. Shanly for extra work, which they undertook and performed, the payment for which was long delayed, and some of it has not even yet been received. These advances of money, when already overburdened with a losing contract, in two seasons of wide-spread financial distress, have contributed to swell their interest account to an amount so great that it has been thought fit to make it a subject of special comment by the attorney general. But in view of the circumstances, there is occasion rather to be surprised that the amount of interest paid was as small as it appears. It is to their credit, and shows their financial strength, that this account is no larger.

Indeed, looking back upon the history of their work under the contract,—considering the capital invested, the security required by the State, the two seasons of financial distress and panic which convulsed the country, the great physical difficulties to be overcome, the strict constructions of the engineers, the withholding of money earned and due, the calls for extra work, the numerous unexpected difficulties which beset the Messrs. Shanly, physical and moral,—the wonder is rather that they ever got through with the work at all. Looking back upon it now, it is simply a marvel that perseverance and pluck endured so long.

## OFFICIAL COMMENDATIONS OF THE MESSRS. SHANLY.

The joint standing committees of the legislature have not failed, from year to year, to recognize the energy, ability and fidelity displayed by them throughout their work.

The committee for 1869 say,—

“We feel called upon to say, generally, that every portion of this stupendous work showed a capacity, thoroughness and energy in its prosecution which speak well for the contractors, and give the best assurance that the work will be completed by them, and within the time prescribed by the contract.” (Senate Doc., 1870, No. 58, p. 3.)

The committee for 1870 say,—

“The committee have made a close examination into every part of the Tunnel work, and have also made themselves perfectly familiar with all the discouraging difficulties which have from time to time been encountered in the progress of the work in the past, and have carefully compared them with all contingencies that may reasonably be anticipated in the future, and they are settled in the opinion that the contractors will be able to finish the Tunnel within the time specified in the contract.” (Senate Doc., 1871, No. 55, pp. 16, 17.)

The committee for 1871 say,—

“Since the last session, we have visited and examined the workings of the contractors of the Hoosac Tunnel, and find much reason for satisfaction in the apparent energy and ability displayed in pushing forward the work. The rate of progress then prevailing at the east end of the Tunnel, as ascertained from the state engineer, *was more than twenty-five per cent. in excess of contract rate*, and the report of the whole year’s advance at this point shows an aggregate excess of about sixteen per cent.”

“The progress attained during the past year in the headings, both at the east and west ends of the Tunnel, has considerably exceeded that of the preceding year, *and is now in each of these instances in advance of the point required by the stipulation of the contract.*” (Senate Doc., 1872, No. 250, pp. 4, 5, 14.)

The committee for 1872 say,—

“The progress of this work during the past year seems to evince very commendable diligence and faithfulness on the part of Messrs.

Walter and Francis Shanly, contractors. The advance of heading westward from the central shaft was suspended during more than ten months of the year by reason of enforced delays arising out of the large volume of water encountered, and the apprehension of developing a further increase of quantity which should exceed the resources of the pumping machinery provided for its removal. Notwithstanding the suspension of progress at this single point of advance during the greater part of the year, the great exertions made at the other points of penetration, seconded by very remarkable immunity from any considerable delay, have given an aggregate quantity of work in lineal feet of heading opened during the year which considerably exceeds the amount of advance for that time that would have been reasonably anticipated if the difficulties and dangers of interruption which were to be met with had been fully apprehended." (Senate Doc., 1873, No. 201, pp. 5, 6.)

The committee for 1873 say,—

"The contractors, Messrs. Walter and Francis Shanly, seem to have continued to maintain a high standard of diligence and energy in the prosecution of their work. . . . *It has been a matter of advantage to the enterprise that the contract for its execution should have fallen into the hands of men alike energetic and competent, who have contended successfully with its many difficulties.*" (Senate Doc., 1874, No. 201, pp. 6, 7.)

Mr. Frost, also, in his report for the year 1872, which included the dark and difficult season of this contract, says :

"The operations during the year by Messrs. Walter and Francis Shanly, contractors, upon their contract for the completion of this work, were prosecuted with most excellent resource and energy. . . . They have attained results of progress eminently satisfactory, in view alike of the sources of delay which were apprehended, and of the actual difficulties met and surmounted.

"With the single exception of progress westward from the central shaft, which was suspended in February, the advance of the last year in the work of driving the headings may be said to have been substantially without peculiar hindrances, *and the results obtained have satisfied the most sanguine anticipations.* In the heading from the west end, up to January 1, 1872, the whole length obtained was but 32 feet in excess of the contract requirement. For the year following, the contract would require a progress of 1,200 feet. The actual length penetrated was 1,616 feet, an excess



of more than 33 per cent. This very favorable result is paralleled as to ratio between required and actual rates, by the very creditable, as well as very fortunate progress which has been accomplished *through extraordinary efforts in the heading eastward from the central shaft*. In this the contract rates would require, for the eleven and a half months' work which preceded the junction made with the east-end section, December 12, a length of 920 feet; and the actual amount accomplished was 1,226 feet, an excess of very nearly 33 per cent.

*"It should, however, be remembered that the extraordinary progress is due largely to the extraordinary exertions made."*

#### THEIR CHARACTER AS CONTRACTORS.

These are the comments which have been made from time to time, as the work has proceeded. They are quoted here, because they show the concurring testimony of every legislative committee, year after year, whose official duty it was to examine and report upon their work. They do not leave it in any doubt that the Messrs. Shanly have displayed the highest qualities in the prosecution of this enterprise. To their uprightness and truthfulness, Governor Talbot has borne a willing confirmation. But it needs no witnesses to satisfy you upon this point. Such absolute fidelity to truth as has been shown here by Mr. Walter Shanly, you are not likely to find surpassed. He seems to have taken for his motto the Saxon oath,—

"By Woden, God of Saxons,  
Truth is a thing that I will ever keep,  
Until that day in which I creep  
Into my sepulchre."

Intellectually, he is a man for great tasks and responsibilities, and not for holiday duties; of clear perceptions; of strong convictions; of self-reliance almost unwavering. Such a man is not swayed much either by the doubts or the overconfidence of others. In a matter of high moment, he must needs act upon his own judgment alone. For carrying through an engineering work of supreme difficulty to-day, where is the man you would select in preference to Walter Shanly? Whose judgment would you hold superior to his?

Looking back upon the history of this great enterprise

from the beginning, who, of all those at any time engaged in its prosecution, comes out with the highest and best reputation? It is Walter Shanly. Who else has *succeeded* but the Shanlys? If any other reputations have suffered, no stain has come upon that of these contractors.

Their chief commendation is this: that when natural and physical obstacles alone were almost enough to appall the stoutest heart, they have not been broken down by the addition of needless annoyances, of exactions in matters of detail, —many, perhaps, comparatively petty in themselves, though serious in the aggregate,—of unwise direction and control, and all the ceaseless, nameless vexations springing from a superintendence that was a constant hindrance rather than a help; and that they persevered, even though, in the gravest exigency that has arisen in the progress of the work, the Commonwealth, acting under the advice of its engineers, assumed the responsibility of imperatively controlling their course, holding them responsible for results, while forbidding them to exercise their own judgment as to the best means of accomplishing those results, and forcing them to act in a manner which they at the time proclaimed to be foolish, reckless, ruinous.

Their losses have come upon them through no fault of their own. The history of their connection with the work is now before you; and they are unwilling to believe that the legislature or people of Massachusetts, on reviewing the whole matter, will wish to see them dismissed from the successful execution of this great public work, not only with these heavy outlays to bear, but also with the smarting sense of injustice which springs from the conviction, that, even in spite of the unexpected natural difficulties which they have encountered and overcome, they would have escaped without pecuniary loss but for the unreasonable exactions and requirements to which they have had to submit.

For these reasons, they respectfully ask for an appropriation which shall make good to them their loss.

## HOOSAC TUNNEL CONTRACT.

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*In the matter of certain claims and representations made to the Legislature  
in the PETITION OF W. & F. SHANLY :—*

The undersigned, recently contractors with the Commonwealth for the completion of the Hoosac Tunnel, beg leave to submit, for the information of the representatives of the people of Massachusetts, the following statement in respect of the main point of complaint, set forth in their petition, as having borne heavily and unjustly on them during the prosecution of their work. It has reference to the question of the "water difficulties" encountered in the central-shaft workings of the Tunnel.

In the autumn of 1870, we, the then contractors, had sunk the central shaft down to "grade,"—1,028 feet from surface,—and, as soon as practicable thereafter, proceeded to tunnel each way therefrom, as provided by the contract.

The length of "solid mountain" we then had to penetrate, was as follows :—

Whole distance from east, or "Deerfield," end of Tunnel to the central shaft, . . . . .	12,834 feet,
In which the advance made from the east end towards shaft was about . . . . .	7,790 "
Leaving to penetrate on the east side of mountain, about . . . . .	5,044 feet.
Whole distance on western, or "North Adams," side, was, . . . . .	12,197 feet,
Advance from western portal towards shaft, about . . . . .	5,522 "
Leaving to penetrate on west side of mountain, about, . . . . .	6,675 feet.

On or about November 1, then, having, as stated, reached bottom in the shaft, we had, as it were, two distinct tunnels on our hands,—

One eastward from centre, . . . . .	5,044 feet long,
One westward       “ . . . . .	6,675       “

Each with a working face, or “point of attack,” at either end, —four faces in all.

The contract prescribed certain monthly rates of progress to be made on each face, as follows:—

From easterly, or Deerfield, end, . . . . .	125 feet.
“   central shaft, 80 feet each way, . . . . .	160   “
“   westerly, or North Adams, end, . . . . .	100   “

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Whole monthly progress stipulated for, . . . . .	385 feet.
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Circumstances, which we are about to narrate, rendered it after a time inexpedient, if not impossible, in our judgment, to adhere to that requirement of the contract which provided for all four faces, or “headings” as they are called, being continuously worked, and, accordingly, in one of those headings, the westward one of the central-shaft workings, we wholly suspended progress for about seven months; namely, from May 22 to late in December, 1872.

It is to this suspension that we desire specially to direct attention, because in the hearing of our case before the committee on claims, it seemed to be specially leaned upon by the attorney-general and state engineers opposing us, that such suspension, being a dereliction of contract, put us, the petitioners, so to speak, “out of court”; that we had “no case.” The fact of the Tunnel having been finished in ample time, notwithstanding the delay at one particular point, a delay advisedly made by us, was not to be allowed in the pleadings at all. That, at least, was our understanding of the attorney-general’s position.



We may here state, that on the *three* faces, which we always did work "continuously," we frequently made more progress in a month (notably, in one month, 44 feet more) than the contract prescribed for the aggregate progress for all *four* faces; and we will add that our *average* monthly progress during the seven months of suspension, which are charged against us as a breach of contract, exceeded on the three faces the 385 feet monthly aggregate required by the contract. The contract distinctly provided that we were to be judged by our monthly *averages*.

The first indications of "wet ground" west of central shaft, were met with in March, 1871, when the "heading" had been advanced in that direction less than 200 feet. The **March, 1871.** "flow" had then increased to such an extent (to some 80 gallons per minute from 23 gallons which it had previously been) that work in the Tunnel on both sides of the shaft had to be suspended until very large pumping appliances could be provided in addition to such as we already had.

The new pumping machinery was finally completed in October (1871), and work *eastwards* from the shaft resumed in November; but the threatenings of more water in the **Nov. 1871.** *western* face were so significant, that we deemed it the part of prudence not to break further into the rock on that side, as no human foresight could undertake to determine to what extent the water might increase if continued to be "tapped."

At this date work was fully under way, eastward, with a view to pressing it with all possible despatch on that side (the eastward rock yielding very little water), until **Nov. 17.** by union with the heading advancing from the east end of the Tunnel an outlet could be gained and the westward advance resumed without incurring the risk of its "drowning us out" with its unknown quantity of water.

On the date mentioned (November 17, 1871), upon our applying, in the usual course, for payment of our monthly estimate, we were informed that it and those to become due thereafter

would be "stopped" unless we at once proceeded to advance westward from the shaft.

Having a very large capital then invested in the undertaking, we were not in a position to combat what we considered the very rash order thus given us to "go ahead west, water or no water," and, accordingly, contrary to the dictates of our own judgment, and under compulsion, we again broke-in on the west face, and continued to do so, with ever-increasing accession of **Feb'y,**  
**1872.** water, until February 12, 1872, when, the flow having increased to upwards of 100 gallons per minute, we again suspended, in the confident expectation that the evident and imminent risk of filling the shaft (more than 1,000 feet in depth) would lead the state authorities to view the hazardous matter from the same stand-point—that of safety—that we, the contractors, did.

In the above-expressed expectation we were disappointed, for on March 2 official notification was served upon us **March,**  
**1872.** that an order in council had been passed to the effect that no excuse would be accepted for suspension of work in west heading. On March 14 we had an audience of the governor and council, in the hope and belief that on a personal representation of all the facts it would not be insisted on that we should incur the great risk—a risking of state interests equally with our own—of attempting further to penetrate the water-bearing rock until a junction of eastward headings could be effected, and the water so allowed to "run." Here again we were doomed to be disappointed, and left the council chamber bearing with us imperative orders to "go on west, anyhow."

We did so, always under threat of our estimates being stopped, until about May 22, when the flow of water **May 22,**  
**1872.** had increased to upwards of 200 gallons per minute, entirely overpowering the pumps, and compelling us, in order to prevent the shaft from filling, and to allow of the *eastward* heading being prosecuted, to apply the machinery designed for the hoisting of rock only to the baling of water, and also obliging us to sub-stitute for the lesser of the two pumps already in use another one of larger capacity.

We now (May 22, 1872) resolved on a permanent desistance from the folly of "daring" the water any further, let the consequences to ourselves be what they might, and suspended westward advance once more. Shortly afterwards, however (June 14), we were served with copy of another order in council, again threatening non-payment of the money due us month by month because of this our last stoppage of westward progress. June,  
1872.

In respect of this last order, we had two interviews with the executive,—on 20th and 28th June, respectively,—the results of which weré, that while the threat of "no pay" was still kept impending over us, we were tacitly permitted (at last) to carry out our own plans; and accordingly, and of course, we made no further efforts to force our way westwards until after the eastward headings had come together,—an event that took place on December 12 (1872).

We speak advisedly when we say that had the order of June 14 been enforced by the state authorities, and coercive measures continued towards us, the central shaft would have filled, and we confidently believe that had that taken place the problem of "what to do with it" would be unsolved to-day.

Meantime the general results of the compulsory and unreasoning action taken towards us between November 17, 1871, and March 14, 1872, may be briefly summed up thus:—

Advance made westwards,	. . . . .	144 feet.
Increased accession of water in that distance,		130 gals. per min.
Needless outlay and loss forced on the contractors,	. . . . .	\$217,000

While in the eastward advance, on the progress of which the very *salvation* of the Tunnel was depending, we lost, through the numberless, nameless and ceaseless delays and inconveniences caused by having to "fight" the water needlessly turned loose in the west heading, fully two months' time; that is to say, that had we been let alone in the first instance, the junction of headings (east), which actually took place December

12 (1872), would certainly have been accomplished two months earlier, and, by achieving so much sooner that final conquest of the danger (the filling of the shaft), which had then been threatening the successful completion of the Hoosac Tunnel for more than a year, we would have gained just so much time also on our "fresh departure" westwards.

The argument used by the state engineers, in counselling the executive to compel us to keep cutting into the water-bearing rock, was, that it was merely a question of pumps. "Make those contractors," they said, "put in more pumps, and keep putting them in as the water increases."

There are certain common-sense answers to that line of argument, a few of which we will cite:—

1st. One fact was clearly established in March, 1871,—as to the character of the rock westwards from the shaft,—*it was very wet*. Its yield of water, when we were compelled to break into it afterwards, increased in the short space of 144 feet from about 80 to an average of 213 gallons per minute. "How many pumps do you want us to put in?" we asked. "Will you undertake to fix the *maximum* flow that may possibly be encountered in the 3,000 feet (almost) that we are expected to drive westward from the shaft?" Were the water to keep gaining in the same *ratio* that it did for the last 144 feet of penetration, we would have had upwards of 2,000 gallons per minute to contend with ere we had reached our contract limit of westward advance. Two thousand gallons a minute! and who could say for certain that it was not there, would have required to keep it down thirteen such pumps as our largest one.

2d. The pumping-power we had provided previous to the threatening step taken towards us on 17th November, 1871, was easily capable of dealing with all the water "cut" up to that time and with any probable accession to be expected as we advanced east. Had we not been interfered with then, we never would have had any "water trouble" to vex us, and eastern progress would have been made with such regularity and rapidity as to render the completion of the Tunnel (allowing



the westward advance to stand still for seven months) within the time limited by our contract a dead certainty; whereas, by keeping on west, blindly and madly, there was, as far as appearances allowed one to judge, almost an equal certainty of the water conquering any possible pumping-power that could be brought to bear upon it; to result, as we have said, in the filling of the shaft,—the signal, looked for by some, for the final abandonment of the Hoosac Tunnel.

3d. The large pump we did put in after our first warning of wet ground in March, 1871, cost us \$56,000 in money, and the getting of it in compelled the suspension of all tunnel-work, *both ways from the shaft*, for about seven months. Had we been forced, as it was tried to force us, to put in another such pump, we would have lost seven months more of progress eastwards, and in eastward progress, be it remembered, lay the *only certain and irrefutable solution of the water problem*. As a matter of fact, it proved, when we did come to resume progress westward (that is to say, after we had succeeded in obtaining an easterly outlet), that had we encountered the delay of putting in a second large pump, and continued, after May 22, 1872, to try and force our way in the water-bearing rock, a third one, with its corresponding loss of time, would, on the same grounds, have been demanded before we had reached half the distance that we were expected to advance from the shaft towards North Adams. Under such a condition of things,—three times seven months loss of time in order that an engineer's specification might be held inviolate,—the paragraph on tunnel affairs in the chief magistrate's annual message to the legislature might have been somewhat hard to frame. Long delays in, or the possible indefinite postponement of, the completion of the Tunnel, would have been but poorly compensated for to the Commonwealth, by the inevitable resulting ruin of the contractors,—the latter consequence being assumed as of no account one way or the other.

4th. The central shaft was "contrived a double debt to pay." The rock, which was to be the measure, month by month, of progress in the middle workings of the Tunnel, had to be brought to surface through it. The water that embarrassed

the workings had also to be lifted through it. Had we harkened to the counsels of the state engineers, and continued to fight our way westwards by stress of pumping, we would have had the shaft so chockful of pump-gearing that it would have had to be abandoned in its use as a road for rock; when, of course, it would have ceased to be a means of advancement of work. We held that the great aim and end of this most costly pit, was to get up all the rock we could, and so gain progress. The engineers seemed to say, "Never mind the *rock*; get all the *water* you can, and bring *it* up."

5th. We remember to have heard it asked in the time of our trouble, "How is it that deep mines without number are relieved of water in much larger quantities than were ever encountered in the central-shaft workings of the Hoosac Tunnel? To that we answered, simply, that in mines, properly so called, where the workings are expected to be for all time, the WORKING-SHAFT and the PUMPING-SHAFT are separate and distinct, neither one interfering with the uses or operations of the other.

We repeat, now, that when, after getting our pumps to work, in 1871, we decided on directing all our energies and resources to forcing a way out through the dry ground eastward of the shaft, and not again to challenge an unequal combat with the influx of water, certain to follow a westerly advance at the same time, we, not alone as contractors, but also as engineers of some experience in hydraulic works, adopted the only prudent and safe course in view of the situation,—prudent and safe, not in our own interests solely, but in the interests of Massachusetts as well; and that it was so was ultimately, though tacitly, and, as it were by sufferance,—and not graciously,—admitted when, at last, we were allowed to act upon our own judgment and carry out our own views,—a time, however, that, unhappily for us, did not arrive until we had been forced into a needless expenditure of upwards of \$200,000 in vain attempts to conquer the impracticable.

If we have been somewhat diffuse and tedious in our exposition of this water question at the central shaft, it is because

we feel, and can never cease to feel, that in what we had to submit to there at the hands of the state authorities, a great wrong was done us ; and also because while we had many minor wrongs and unfair dealing in other ways to harass us, this in point of magnitude and ruinous consequences to ourselves overshadowed all the others. In the hearing before the committee on claims, it was sought to be shown that in our way of prosecuting our work we paid but scant heed to the stipulations of the contract in respect of rates of progress, at the several points, as therein laid down. That is quite true : we did not ; and we readily and cheerfully enter a plea of guilty to that count in the indictment,—adding, that whenever and wherever it came to be an issue between carrying *out* the specification and carrying *on* the work, we never for a moment paused in the course we had laid down for ourselves, or hesitated to treat that document,—the specification,—so sacred in the eyes of the state engineers, as other than a meaningless and obstructive encumbrance where too literally construed. But as a consequence of our thus asserting our independence of all such trammels, and of our declining to hold out our wrists and allow those engineers to manacle us with red-tape, and we had so to assert ourselves in the very earliest stages of our undertaking, we were ever afterwards made to feel that we had to carry out our engagements as best we could under hostile supervision.

Now that we are no longer contractors with the Commonwealth, and the work to which we have devoted upwards of five years of our lives has been officially taken off our hands as finished, the one fact in connection therewith, to which we turn with unmixed satisfaction, and which we believe the PEOPLE recognize now and will remember in the future, is that, notwithstanding the countless difficulties, natural and artificial, which beset our path, the great tunnel through the Hoosac Mountain is to-day a reality, and was made ready by us to receive a *double* line of rails from daylight to daylight, before a *single* line had been laid to it at either end ! Could all the facts of our position be placed before the people of Massachusetts in the same voluminous detail that they have been before the committee of the legislature to which was referred the hearing of the case, we feel well assured in ourselves that the

verdict would be, "The Shanlys have completed their engagements to the State, honorably and in good time, in the face of natural obstructions greater than were, or could have been, foreseen, and in spite of artificial ones that should never have been allowed to exist."

W. & F. SHANLY.

REVERE HOUSE, BOSTON, March 16, 1875.



SENATE . . . . No. 61.

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Commonwealth of Massachusetts.

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BOSTON, Feb. 16th, 1869.

Hon. ROBERT C. PITMAN, *President of the Senate.*

SIR:—I have the honor herewith to transmit the Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel, for the year 1868.

With great respect,  
I have the honor to be,  
Your obedient servant,

WM. SCHOULER.

## Commonwealth of Massachusetts.

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The Joint Standing Committee of 1868, on the Hoosac Tunnel and the Troy and Greenfield Railroad, respectfully submit the following

### R E P O R T :

During the past year the railroad has been completed to a point one mile east of the tunnel, where station buildings have been erected. The Fitchburg and Vermont and Massachusetts Railroad Companies have accepted the road from Greenfield to the above-named point under their lease from the Commonwealth, and the latter company is operating the same with regular daily trains. Under their direction and at their cost, the public road over the mountain to North Adams has been repaired and improved, and an excellent line of stage-coaches has been established, making daily and direct connections with the line of railroad westward to Troy.

Though these arrangements were not completed till late in the season, the route has attracted a greater amount of travel than had been anticipated, and such as to insure its continuous maintenance and the promise of handsomely remunerative results.

Regular trains commenced running to Shelburne Falls, 13 miles above Greenfield, on 1st January, 1868, as heretofore reported. On the 17th August, 1868, and continuously since that date, they have been running to the tunnel. Since the opening through to the tunnel, receipts both from passengers and freight have been augmented in full proportion to the distance run, and an early and rapid further increase in freight earnings is predicted by the officers of the road, as lumber manufactures are briskly springing up along the line to profit by the new facilities it affords.

So far as traffic across the mountain is concerned, the present terminus directly over the river from the stage office at Jenks and Rice's hotel, and communicating therewith by a substantial bridge constructed during the past summer, is in the most available location and is sufficiently convenient. It is intended, however, that the tunnel excavation hereafter carried out of the east end, shall be utilized towards the embankment east of and adjoining to the railroad bridge now building, and on the completion of the bridge and embankment, it will be very desirable that the track should be extended up to the immediate vicinity of the tunnel.

The total cost to the State of the railroad, exclusive of the tunnel and of the price (\$200,000) paid for the Southern Vermont Railroad, up to Jan. 1st, 1869, appears in the "Commissioners' Statement" appended to the Report of the Consulting Engineer, (Senate Doc. No. 6, 1869,) as follows:—

Amount advanced by the State to construct the Troy and Greenfield R.R. under chap. 202 of the Acts of 1860, to the contractors, Messrs. Haupt & Co.,	\$181,428 00
Advanced by the State to settle Messrs. Haupt & Co.'s liabilities for labor, land damages, &c.,	175,000 00
Total expenditures since August, 1861, to complete the Troy and Greenfield R. R. from Greenfield to Tunnel Station,	640,607 16
Repairs under the lease,	3,887 13
Total amount already expended as above,	\$1,300,922 29

The work of the tunnel within the limits of time and means put at the disposal of the commissioners has been prosecuted with energy and success. The result of the last year's operations largely exceeds that of the preceding year, and still more that of the second preceding, when measured by the standard of advance of headings and cubic yards of material removed from the tunnel and irrespective of the auxiliary works accomplished.

From the table of progress for three years, hereafter subjoined (Appendix A,) we may derive the following condensed comparison of leading items:—

YEAR.	Headings driven, Linear feet.	Tunnelling removed, Cubic yards.	SHAFT EXCAVATION.		AGGREGATES.	
			Linear feet.	Cubic yards.	Linear feet.	Cubic yards.
1866	1,247	7,489	428	2,711	1,675	10,200
1867	1,594	14,410	329	2,968	1,923	17,378
1868	2,082	22,121	75	175	2,157	22,296

The steadily increasing amounts of the aggregates are at once creditable to the recent management of the work and full of hopeful augury for the future.

Within the year just closed, in addition to the foregoing results, special works tending largely to efficiency and success in future operations have been executed as follows: The pneumatic power at the east end has been increased nearly three-fold. For the distance of nearly half a mile the "bottoming," or trimming floor of tunnel to grade, heretofore omitted, has been brought up, and permanent central drain constructed, with permanent pipes therein to replace the temporary arrangements by which air was previously conveyed to the heading for purposes of power and ventilation. The central shaft has been cleared up and refitted with improved appliances. At the western workings, pumping is superseded by drainage through the newly opened adit, and the power hitherto consumed in pumping is available for the pneumatic drills already introduced and operated. The manufacture of nitro-glycerine has been expedited and the processes improved so as to give a better article as well as a larger product. A uniformly abundant supply appears now to be procurable, and an extended practical test of its efficiency has been made with gratifying results.

The entire amount expended by the commissioners for the work of the Hoosac Tunnel as appearing January 1, 1869, and the separate aggregates of each several item of expenditure are exhibited in a statement hereto appended, (Appendix B.)

The work has now been assigned under contract to Messrs. Walter and Francis Shanly of Canada, upon terms believed the most favorable that could be secured to the Commonwealth, in conjunction with the high standard of guarantee which the Act of the last session authorizing the contract expressly and prom-



inently requires. While the Commonwealth under the contract thus executed is amply secured by the reservations of payment and heavy investments required to be made by the contractors at the outset and continued throughout, the high character and wide reputation of these gentlemen as efficient conductors of large and costly works seem to afford all reasonable certainty of their success.

A brief account of the results attained in the prosecution of the work last year will be found in the subjoined communication, coupled with remarks which apply to the contract under which the farther operations are to be conducted.

Hon. Wm. SCHOULER, *Chairman of the Joint Standing Committee of 1868 on the Hoosac Tunnel and Troy and Greenfield Railroad:*

DEAR SIR,—I have the pleasure, in compliance with your request, to transmit the following memorandum of details regarding the work at the Hoosac Tunnel, many of which have been already verbally communicated to yourself and other members of the committee during your visits of inspection:—

It is proper in advance to mention that the operations of the year ending with October last, though showing results of progress and quantities of excavation exceeding those which had been previously attained, have yet been materially curtailed in the later months by the limited means which the Act of the last session placed at the disposal of the commissioners.

After the passage of this Act it was evident that the amount made available was insufficient for driving the work at all points open to progress. It became necessary to confine expenditure to those which were of greatest importance, or to such provisions of machinery and improvements in methods of operation as should place the work in the most favorable condition for inviting proposals from contractors.

Although the conduct of the work during part of the time was much limited by these considerations—and generally the most difficult portions were undertaken—it is satisfactory to remark that the aggregates, both of cubic yards removed and linear advance, have very materially exceeded those of the preceding year, as is shown in the following statement:—

Total length of adit and headings driven in year	
ending Nov. 1, 1867, . . . . .	= 1,594 feet.
Total length of adit and headings driven in year	
ending Nov. 1, 1868, . . . . .	= 2,082 "
Total cubic yards removed from tunnel in year ending	
Nov. 1, 1867, . . . . .	= 14,410
Total cubic yards removed from tunnel in year ending	
Nov. 1, 1868, . . . . .	= 22,121

I further submit (enclosed herewith) a table of comparative progress of the whole work for three years ending November 1, 1868, and a statement of total expenditures down to January 1, 1869.

Some of the more prominent improvements which have been accomplished during the workings of the past summer are briefly enumerated in the following items:—

1. The air-compressing machinery at the east end has been thoroughly repaired and increased by the addition of two turbine wheels, with four-cylinder compressors attached to each, making the present machinery available for pneumatic power nearly three times as great as that heretofore in use; and other necessary constructions of much importance have been executed.

2. New buildings and machinery of improved capacity have been placed at the central shaft, the water has been baled out and the debris removed, and the work at this point is in entire readiness for immediate progress.

3. In the workings eastward from west shaft, the substitution of machine-drilling for hand-labor and employment of nitro-glycerine as an explosive have been the means of gradually improving the progress made, so that the latest month's record nearly doubles that of earlier months' work in similar and even less difficult material.

4. In workings driven westward from the west shaft the large inflow of water has throughout this whole period, and especially with the insufficient pumping apparatus in use during the earlier months, added largely to the cost and seriously retarded progress. This source of difficulty is now entirely removed by the opening of the adit, affording free flow of water through the west end of the tunnel.

These successes were already visibly insured, and their fulfilment was counted on at the time of receiving proposals; and the results then in progress of attainment no doubt had much influence in



# PROFILE OF HOOSAC MOUNTAIN.

Hor. Scale 4000 feet to 1 inch.  
Vert. " 1000 " " "

West Summit

June 1<sup>st</sup> 1870

West Shaft

Well N<sup>o</sup> 4

West Portal  
766 ft. above tide level

East Summit

June 1. 1870

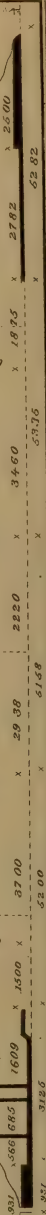
Headings meet  
Sept 23 1872

Central Shaft

Headings meet  
July 1<sup>st</sup> 1873

East Portal  
766 ft. above tide level

100 ft. per Month. 80 ft. per Month. 125 ft. per Month.





determining the favorable character of the bids under requirements of progress previously believed by many to be unattainable.

In view of the doubts which have been expressed in regard to the propriety of these conditions of the bidding, it is here to be stated that, at the time of suspension, each of the several portions of the work had attained and was maintaining rates of progress, relatively to force employed, in excess of those referred to. The large capital invested and interests involved make an early date of completion for the tunnel a matter of great importance to the Commonwealth.

In the contract recently entered into with the Messrs. Shanly, the original requirements of progress are retained. They exact the opening of the headings throughout in about four and a half years, and the full completion of the tunnel excavation, railway track and all accessory constructions within five years from the first day of March next.

A provisional clause gives power to the governor and council, in event of unusual emergency, to grant further indulgence of time, not to exceed in all six months, beyond the date last stated.

While stipulating for the insertion of this last clause for their greater security against forfeiture in event of any serious accidental causes of delay, the contractors express all reasonable confidence of being able to anticipate, by a considerable time, the date of completion prescribed. In this confidence I fully share; and since, under the conditions imposed by the law, a sum gradually accumulating and at last amounting to the aggregate of one million of dollars is to be withheld from payment until the full accomplishment of the undertaking, it is easy to perceive that they have the most powerful inducements to exert their utmost endeavors.

The accompanying diagram has been prepared for the purpose of exhibiting as concisely as possible the leading conditions of the original project as regards lengths and elevations in profile, together with the extent of the work already done and the length of the portion yet remaining to be penetrated; this portion being subdivided into three sections of 5,200 feet, 5,158 feet, and 5,335 feet as belonging to western, central and eastern workings respectively, and representing thereby stipulated progress in each, to which, according to the contract, the future workings must substantially conform. The prescribed monthly rates of advance on each section are severally indicated, and also the points expected to be attained by the eastern and western drifts at the date, (June 1, 1870,) when the computed completion of central shaft excavation and machinery will afford two additional working faces.

The diagram further shows the points and dates at which the approaching faces are computed to meet, viz.: To the eastward of central shaft, Sept. 23, 1872; to the westward, July 1, 1873.

Though very great advance has been accomplished by aid of the improvements effected during the past season, I find still further opportunities of advantage to be secured through increasing skill in workmen, and future improvements in methods and materials employed, all to be the legitimate reward of careful and diligent attention on the part of the contractors.

With entire confidence in the successful future of this great enterprise, and satisfied of the energy and ability of the gentlemen who have undertaken its prosecution,

I have the honor to remain,

Your obedient servant,

BENJAMIN D. FROST,

*Superintending Engineer.*

NORTH ADAMS, MASS, Jan. 28, 1869.

We have now the satisfaction of believing that this matter, heretofore the subject of so much of agitation and controversy, has been fully, satisfactorily and finally settled, and the completion of the enterprise insured in conformity with the expressed will of the legislature. The argument has been persistently pressed by its opponents that the physical difficulties of the work were insuperable, or at least incapable of definite ascertainment and valuation; hence that the estimates of time and cost were simply imaginative, and any expectations founded upon them likely to prove illusory.

The unanimous testimony of men who make such works the occupation of their lives, sustained by the past history both of this work and that at Mt. Cenis, abundantly disproves these positions. The undeniable facts of progress made show beyond contradiction or cavil what *can* be done; what *will* be done may be inferred from the large stake the contractors have in its accomplishment, and the final result be foretold as certainly as we may predict the returns of commercial, manufacturing or even agricultural enterprise.

Upon the question of the probable necessary cost to the contractors as bearing upon their ability to accomplish what they have undertaken, we propose to cite a few facts and arguments; not because they are *new*, but for the very opposite reason,

because they are old, familiar to many, and have been under public consideration long enough to command implicit credence in the absence of anything like refutation.

The cost of constructing five tunnels in France, (see Storow's Report, p. 72 in Troy and Greenfield Commissioners' Report for 1863,) through hard granite, was, respectively, \$383, \$394, \$373, \$362 and \$362 per running yard, or an average of \$125 per foot. Add 50 per cent. for the depreciation of our currency and consequent increased cost, say \$200 per foot in currency, and call the tunnel untouched, and it should cost but about five millions of dollars— $\$200 \times 25,031 = \$5,006,200$ .

These tunnels were worked by hand. Cannot we, with the aid of machinery, do as much in America as can be done in France by manual labor? Having at the outside not over 20,000 feet, or its equivalent, yet to accomplish, (and this is quite an outside estimation,) cannot this work be accomplished for \$600,000 over the cost computed by that of the French tunnels in equally hard material?

Some computations leading to extravagant results have been heretofore presented based on the total outlay hitherto made as compared with the total amount of material actually removed. In some of these computations the permanent outlay has not been distinguished from the current cost. Where this sufficiently palpable error has been avoided there still remains a fallacy in applying a scale of cost enhanced by the difficulties incident to a new enterprise. Year by year the cost per cubic yard has been reduced by improved systems of working.

The more proper way would seem to be to take the results of the workings for a few consecutive months after the appliances had been brought to bear, and the machinery essentially perfected. Such an estimate was made by Mr. Francis, based upon actual results attained by the State, and including, besides every item capable of separate enumeration, a final allowance of near half a million for contingencies. The total sum thus estimated, taking the work as it stood in May last, was a little over \$1,700,000. It is further known that the bids of at least three of the most experienced contractors did not vary essentially from that, nor from each other.



Contractors would make their just and proper profit above cost by their greater economy in producing results, to be attained by their closer oversight of details, or their ingenuity and resource in further perfecting of appliances. While some have argued, and may yet persist in maintaining, that the sum to be paid under the contract is insufficient for its execution, others will perhaps contend that it is unduly liberal, and the margin of possible profit excessive.

No contract could be drawn that should satisfy both these classes of objectors. Fortunately, the law itself defines what shall be deemed a reasonable and proper price for this work; and so much of the valedictory address of the retiring governor as relates to the action of the executive in this regard has the entire approval and hearty concurrence of your Committee.

As to the rate of progress required and expected to be made. Here again the progress of the past is adduced to show that the work cannot be done in any reasonable time. In rule of three it is stated thus: It has been in progress 14 years, and the mountain is penetrated only one-third the distance through. This gives 28 years to finish. A few additional facts are required to illuminate this exceedingly simple calculation; viz.:

Mr. Haupt commenced work in 1857 and stopped in 1861. He excavated 2,400 feet of heading at east end, sunk the west shaft to grade, and did certain work which was finally abandoned as useless at the west end. Thus he worked four years upon one face only. Work was re-commenced in 1864, and has continued till last September nearly continuously at east end, and from half to two-thirds of the time at west end. This refers to workings from the west shaft eastward, and these were *by hand* down to July last.

Under present circumstances, the only true computation must be based on the continuous working of the machines at the east end. The west end difficulties are so far overcome that in the future it assimilates nearly to the former. For a time the rock has been materially harder than at either central shaft or east end; but this was not unanticipated, (see Professor Hitchcock's testimony, p. 39 Commissioners' Report of 1863,) and is already changing for the better and conforming more nearly to the predominating character of the mass of the mountain as developed by those extended excavations. With



the same facilities nearly the same results will be accomplished at all points open to progress. Statistics of advance comprised in reports heretofore published exhibit an average rate for seven months' continuous working of 116 feet per month upon a single face.

As shown by the diagram and explanations on a foregoing page, after allowing amply for time to sink the central shaft, and making deduction for the inconvenience of working in a shaft as compared with an end working, and further abating something on account of the less yielding texture of some of the rock in workings eastward from west shaft, the work can be proved capable of being executed within five years.

Mt. Ceniz tunnel was commenced in 1857 and has already been excavated a distance greater than the whole length of Hoosac, though till 1862 the average monthly progress (which has since exceeded 200 feet per month upon a single face,) was less than 90 feet upon both faces taken together. Taking the earlier progress at Mt. Ceniz as a basis of calculation, it would have required till 1892 to finish it, whereas 1872 will see it opened. If we can attain the same progress they make there, and there is no obvious reason why we should not, the Hoosac Tunnel can be completed materially within the time exacted by the terms of the contract; and this the contractors expect to accomplish.

It has been alleged and believed by many that the reports latterly made of progress at our own tunnel were deceptive to those unfamiliar with such details as conveying ideas somewhat too favorable of the actual advance toward completion. We deem it appropriate, therefore, at this juncture, to make a brief general statement, divested of unnecessary detail, of the present and actual quantities of work done and to be done; of the visible and ascertained character of what yet remains to be executed; and the known conditions and possible contingencies that are to affect its progress.

The total length of the tunnel is four and three-quarters miles, very nearly. From the reports of the engineers it appears that the total distance penetrated from the east end amounts to two feet over one mile, and from the west end to a little exceeding three-fourths of a mile.

This leaves somewhat less than three miles of the mountain yet to be penetrated, which distance is nearly equally divided into two tunnels of one and a half miles each by the location of the central shaft.

Of the one mile penetrated from the east end, the first half mile is excavated nearly to the full dimensions, and will require for its completion the removal along a portion of its length of a quantity equal to the contents of less than three hundred feet of full-size tunnel.

The remaining half mile has been extended as a heading of large dimensions, and comprising an average of somewhat over one-third the full excavation required. Its enlargement may be accomplished without involving delay to the further advance.

Of the three-quarters mile distance penetrated from the west end, nine hundred and thirty-one feet, or over one-sixth mile, will be entirely finished in the ensuing month of February, under B. N. Farren's contract. In the remaining distance, about fifty thousand cubic yards' enlargement is yet to be done. Nearly one-fourth of the total excavation has been taken out as heading. As at the east end, so here, also, the enlargement may be accomplished without delaying the farther progress into the mountain.

Of the west end, hitherto embracing the west shaft workings, (and those of the supplementary shaft and well number four,) but hereafter to be worked without any but mere auxiliary service from them, the present condition affords good grounds of great satisfaction. It is here that delays and disappointments have from the first most seriously embarrassed the enterprise. Here there was constant and great uncertainty as to the amount of water and the character of the material, and the best way of overcoming obstacles was oftentimes not to be devised until they were encountered in all their magnitude.

By the driving through of the adit, this condition of uncertainty is entirely removed as to the whole distance up to and sixteen hundred and nine feet eastward from the west shaft. Beyond the shaft *all the rock is self-sustaining*, and will be found so throughout the mountain. As Prof. Hitchcock has said in another connection, "it would be a thing unheard of in geology were it otherwise."

The chance of a great influx of water during further progress of the tunnel is very remote and improbable, and however great it may be it will discharge itself at either end by natural flow. The present flow is but moderate at the breast of the west end heading and in the central shaft; in which latter, after excluding surface water, the influx is directly proportional to the depth, and the total present amount to be baled daily is only what would rise to the height of six feet if suffered to accumulate.\* At the east end there is not even water enough to answer the purposes of the workings; it has to be conveyed in by pipes.

The proofs derived from actual inspection at the east end, central shaft and west end, are morally irresistible in forcing the conclusion that *progress at all points is to depend hereafter solely on the greater or less hardness of the material, and the greater or less efficiency of the means that may be devised for breaking it up.*

To the contractors, and not to the agents of the Commonwealth, will belong hereafter the task of development and application of means. The only view your Committee need take of the subject is retrospective, and this limited chiefly to the operations of the year just closed. We are gratified to recognize the unremitting efforts at improvement, and the very satisfactory measure of success that has been attained. Interesting particulars will be found in the reports, published or forthcoming, of the commissioners and engineers of the work.

But we are impelled at this particular juncture to a single remark, founded upon a wider retrospect. The conduct of this work has been as a whole creditable to the various agents and officers to which its management has been intrusted by the State since her assumption of the enterprise in 1863. Neither physical obstacles nor partisan opposition have availed against the energy, perseverance and resource with which it has been conducted to its present auspicious condition. The physical obstacles have been great; the opposition bitter and unrelenting. This unremitting opposition has been more serious than the passive resistance of the rock—more costly than pumping.

In saying this no reflection is attempted to be cast upon the judgment or honest purpose of any who have been the oppo-

\* The area of the shaft being 318 square feet, the daily access of water is ( $318 \times 6 =$ ) 1,908 cubic feet, or ten gallons per minute.



nents of the undertaking. But it is right to vindicate the judgment and ability of its projectors, advocates, advisers and executive officers so far as to recognize all the difficulties with which they contended, while we point with sincere satisfaction to the results they have attained. The expenditures, even viewed in the after-light of experience, have been seldom seen to be injudicious—never profligate. In the details of administration differences of opinion were inevitable; but these were either harmonized as they arose or may be forgotten in the general contentment attending the present prosperous attitude of the work, and in hopeful anticipations of its future.

There is little occasion to renew here the discussion of how far or in what way the public treasury will be re-imbursed for its liberal outlays upon the Troy and Greenfield route. No subject is more familiar to the people of this Commonwealth, or the members of this legislature. Nevertheless, in closing this Report we beg leave to quote a passage touching this matter from a paper already referred to in the foregoing pages:—

“The value of great public works, conceived in the necessities of States, looking not to the specific returns of remunerative interest for a single year, or a limited number of years, but rather to the compensation of internal commerce through successive generations, cannot be computed by the rules that govern private investments based on the promise of immediate profit. The finance of individuals comes within the limitations of present and personal interest; the investment of Commonwealths look for a return in their complete development, and in their enduring destiny.”

WM. SCHOULER,  
JONA. D. WHEELER,  
EDMUND H. SAWYER,  
*Of the Senate.*

N. A. THOMPSON,  
GEO. E. TOWNE,  
JAMES A. FOX,  
J. BENTHAM DENNETT,  
L. S. JUDD,  
*Of the House.*



## APPENDIX A.

*Comparative Progress of the Whole Work for Three Years ending November 1st, 1868.*

YEAR.	EAST END.						CEN'L SHAFT.		WEST SHAFT.								SUPPLEMENTAL SHAFT.				WELL No. 4.				WEST END.		FINISH'D TUNNEL.
	HEADING.		ENLARGE- MENT.		BOTTOM AND CENTRAL DRAIN.		Cubic Yards.	Linear Progress.	EAST EN- LARGEMENT.		WEST HEAD- ING.		EAST EN- LARGEMENT.		WEST EN- LARGEMENT.		Cubic Yards.	Linear Progress.	Cubic Yards.	Linear Progress.	Cubic Yards.	Linear Progress.	Cubic Yards.	Linear Progress.	Cubic Yards.	Linear Progress.	
	Linear Pro- gress.	Cubic Yds.	Linear Pro- gress.	Cubic Yds.	Linear Pro- gress.	Cubic Yds.			Linear Pro- gress.	Cubic Yds.	Linear Pro- gress.	Cubic Yds.	Linear Pro- gress.	Cubic Yds.	Linear Pro- gress.	Cubic Yds.											
1866.	592	2,443	167	417	-	-	153	1,993	637	2,358	578	1,444	18	106	294	721	200	579	75	139	131	-	131	-	131	Total East and West.	
1867.	1,051	5,570	1,800	4,391	-	-	229	2,698	235	1,391	96	820	308	958	65	1,280	63	183	37	87	290	66	290	66	356		
.	*802	5,736	2,210	8,697	2,256	2,504	-	-	370	2,587	82	361	910	2,109	-	127	-	-	75	175	334	-	334	-	1,144		

\* Seven and a half months' work.

## APPENDIX B.

*Statement of the amounts expended upon all work done on the Hoosac Tunnel, under the direction of the Commissioners, up to January 1, 1869.*

Deerfield Dam, . . . . .	\$127,727 53
Race, . . . . .	26,570 92
Excavation and masonry at east end of dam, . . . . .	12,802 46
Wheel pits, . . . . .	81,219 17
Gates and overflow, . . . . .	10,026 56
East end heading, . . . . .	238,964 43
" enlargement, . . . . .	208,918 96
" heading enlargement, . . . . .	17,710 96
Central shaft, . . . . .	225,800 87
West shaft, . . . . .	421,031 53
West approach, . . . . .	538,644 12
Buildings, east end, . . . . .	29,954 76
" west end and shaft, . . . . .	40,363 04
" central shaft, . . . . .	19,044 73
" general account, . . . . .	9,499 06
Engineering and superintendence, . . . . .	109,840 95
Machinery, east end, . . . . .	164,138 39
" Deerfield Dam, . . . . .	10,820 93
" central shaft, . . . . .	75,895 66
" west shaft, . . . . .	117,331 33
" west end, . . . . .	576 84
" general account, . . . . .	63,971 53
Land and land damages, . . . . .	20,077 54

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Total expended up to January 1, 1869, . . . \$2,570,932 27

100 /

SENATE....No. 58.

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Commonwealth of Massachusetts.

To the Honorable H. H. COOLIDGE, *President of the Senate.*

SIR:—I have the honor herewith to transmit the Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel for the year 1869.

With great respect,

I have the honor to be,

Your obedient servant,

GEO. O. BRASTOW.

FEBRUARY 15th, 1870.

## Commonwealth of Massachusetts.

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The Joint Standing Committee of 1869 on the Troy and Greenfield Railroad and Hoosac Tunnel, respectfully submit the following

### R E P O R T:

That portion of the Troy and Greenfield Railroad extending from Greenfield to the Tunnel, having been so far completed as to have been accepted and leased by the State to the Fitchburg and the Vermont and Massachusetts Railroad Companies, and the entire work of completing the Tunnel having been put under contract by the State to Messrs. Walter and Francis Shanly, and the care, management and supervision of the work on the Tunnel, as well as the mode and times of payment for the same, having been placed in the hands of the governor and council by previous Acts of the legislature, the Committee found their duties somewhat circumscribed.

In compliance, however, with the requirements of the second rule of the Joint Rules and Orders of 1869, the Committee have performed what they understand to be the duty enjoined by this rule.

The Committee first visited the Road and Tunnel in July. They passed over the line from Greenfield to the Tunnel under lease to and operated by the Fitchburg and Vermont and Massachusetts Railroads. Although they made no critical examination of this portion of the road, they cannot omit to say, that they were impressed with the evidence, already palpable, that this is a portion of a line of road even now of great public importance, to say nothing of what it must be when the Tunnel is completed.



The road passes almost the entire distance along the banks of or near the Deerfield River, making it one of the most picturesque, beautiful and attractive routes in New England. At the Tunnel, it connected with a line of stages to North Adams, most admirable for convenience, strength and safety. The unrivalled beauty and grandeur of the scenery over the Hoosac Mountain was also attracting much summer travel in that direction. This piece of road is of the greatest local importance to the people and business of the western part of Franklin County, especially to the thriving manufacturing village of Shelburne Falls. The road seemed to be in good working order, well managed, and doing a fair business. And although, when the Tunnel is completed, and this becomes a great through route, essential modifications of its curves and structure may be required, still it is now a work of which the State may well feel proud.

The Committee next visited the Tunnel. And here they made a personal examination and inspection of every portion of this great work. Every facility was afforded by Messrs. Shanly, the contractors, and Mr. Frost, the engineer, to enable the Committee to examine and see for themselves what was being done, how it was done, and what were the prospects for the future.

And while the Committee must of course rely upon the engineer for all the detailed and minute measurements and statements as to the progress of the work; the amount done in a month or a year; how far these amounts fall short of or exceed the conditions of the contract with the Messrs. Shanly, we feel called upon to say generally, that every portion of this stupendous work showed a capacity, thoroughness and energy in its prosecution which speak well for the contractors, and give the best assurance that the work will be completed by them, and within the time prescribed by the contract.

But in order to give a more exact statement of the facts in the case, and the progress of the work during the year 1869, the Committee incorporate into the Report the following communication and diagram, from the superintending engineer:—

ENGINEERS' OFFICE, HOOSAC TUNNEL, }  
NORTH ADAMS, MASS., February 5, 1870. }

To the Hon. GEORGE O. BRASTOW, *Chairman of Joint Standing Committee of 1869, on the Hoosac Tunnel and Troy and Greenfield Railroad.*

DEAR SIR:—In accordance with your request I have the pleasure to transmit the following statements respecting the progress made in the Tunnel during the past year.

As was stated in the reports of preceding years, all work of building the Tunnel had been suspended previous to the first day of January, 1869, excepting the prosecution by B. N. Farren, of his unfinished contract for construction of a certain portion of brick arch in the West End. He completed this early in the month of February, having made the advance after January 1st of forty-eight feet of completed tunnel.

Early in the ensuing month (March,) the Messrs. Shanly, contractors for completion of the tunnel, had so far matured their plans that they employed small forces near the works on matters preparatory to a commencement of operations; but the completion of their negotiations with the agent of the Commonwealth, appointed for transfer and sale of State property, was not attained until the 26th of March.

On that day the works were formally given into their hands, and very shortly after, their forces were applied both at the East and West Ends of the Tunnel. On the 5th of April excavation of rock was started in the West Shaft workings, and on the same day bailing of water from the Central Shaft commenced.

While partial beginnings were thus made it was necessary to accomplish much preparatory work before full operations could be undertaken at all the principal points. The actual excavations of rock in the headings and in sinking the Central Shaft were commenced as follows:—

East End Heading,	.	.	.	.	.	March 29.
Sinking Central Shaft,	.	.	.	.	.	May 20.
West End Heading,	.	.	.	.	.	July 2.

The distances advanced and value of work done under Shanlys' contract during the year 1869, are shown on the following:—

*Comparative Statement of work done during the year 1869, and of work remaining to be done under F. Shanly & Co.'s contract for completion of Hoosac Tunnel.*

	Work done in December.		Total work done.		Work to be done.		Whole Amount of Contract.	
Lineal feet of Headings, .	248	—	1,688	—	14,005	—	15,693	—
Value of all Tunnel work, .	—	\$54,735 72	—	\$405,948 23	—	\$3,922,024 77	—	\$4,327,973 00
Lineal feet of Shaft to grade, .	30	—	215	—	232	—	447	—
Value of all Shaft work, .	—	11,534 24	—	92,271 24	—	107,523 76	—	199,795 00
Railway track, .	—	—	—	—	—	66,500 00	—	66,500 00
Deduct work and material furnished by State, . . . }	—	\$66,269 96	—	\$498,219 47	—	\$4,096,048 53	—	\$4,594,268 00
Amount of work by F. Shanly & Co., . . . }	. . .	. . .	. . .	5,830 70	. . .			
	. . .	. . .	. . .	\$492,388 77				

It should be borne in mind that the present work in the Central Section of the Tunnel is limited to the single force employed in sinking the Central Shaft. After grade of the Tunnel is reached two breasts for working will be opened, and opportunity afforded for large addition to monthly value of work done.

Delays made by those who had contracted to deliver machinery and material, and more than the average proportion of hindrance from exceptional causes, have combined to reduce the earlier progress of the contractors below their reasonable expectation. Such contingencies become the less probable in proportion as the work gains a more thorough equipment and organization.

After making such allowance as properly belongs to the considerations above named, the experience of the past year's work may be held to confirm the conclusions, which were announced in the reports made at its commencement, as to the practicability of maintaining the average rates of progress named in the contract, and of completing the tunnel within the limit of time which it prescribes.

In January, 1869, I furnished to the Joint Standing Committee of 1868, a diagram showing the anticipations then entertained as to the commencement and progress of work in the Tunnel. Although the terms of the contract allowed a considerable discretionary margin of time to the contractors before beginning their operations, it was supposed that they would find it convenient to initiate partial and preliminary workings forthwith and be ready to commence full rates of progress by the 1st of March. By commencing at that date and conforming exactly to the stated requirements of the contract, they would have completed the latest headings by the 1st of July, 1873; and, allowing three months additional time as probably requisite for bringing up unfinished work on enlargements, laying drains and railway track, etc., the final opening of the tunnel for passage of railway trains would have been accomplished by the first of October, 1873, or five months in advance of time prescribed by the contract.

The contractors have found it more convenient, however, in making commencement and conducting their earlier operations, to avail of the full measure of delay which the contract allows, having in view completion by the first day of March, 1874; and appearances now indicate that they are not likely to anticipate that date in completion.

It is certain that with a less regard to economy in application of force they might have driven some portions of the work forward more rapidly. In some points considerations of economic management or temporary difficulties have caused them to fall behind the



full requirements of their contract. These obstacles are in part due to exceptional contingencies of the sort to which any enterprise is liable, and in part to the fact that the portions of East End Heading opened by the State, through which the enlargement is now advancing, were not conducted in the manner most advantageous for subsequent operations.

Some of the above-named difficulties will be removed in the course of two or three months, and at the very latest, in ordinary course of progress, by October or November next. After these shall successively disappear the contractors may be expected, not only to accomplish the average rates mentioned in the contract, but also, gradually, to make up the arrearages of the previous months.

The aggregate distances of advance made by the State and by the contractors, are shown in the following—

*Statement showing the present workings on the Hoosac Tunnel, Lengths of Heading and depth of Central Shaft driven, and lengths remaining to be done January 1, 1870.*

HEADINGS.	DISTANCES PENETRATED—			Lengths remaining to be Penetrated.
	By State to January 1, 1869.	By F. Shanly & Co., in 1869.	Aggregate done to January 1, 1870.	
	Feet.	Feet.	Feet.	Feet.
East End Section, . . .	5,282	1,239	6,521	} 14,005
West End Section, . . .	4,056	449	4,505	
Aggregate of Headings,	9,338	1,688	11,026	14,005
Central Shaft, . . . .	583	215	798	232

During the month of December, 1869, the progress of the East End Heading was 146 feet and progress of the West End Heading 102 feet, being respectively 21 feet and 2 feet in excess of the several average rates named in contract. In estimating for future progress, however, I find it more appropriate to adhere to those rates for the ruling points of accomplishment, as giving the more reasonable groundwork for average expectation; while I think that improvements in equipment, &c., will lead to larger advances for part of the time, such anticipated excess should not be too soon appropriated into our calculations, but for the present

may be left as an offset against the contingencies and interruptions, by which the work of some months will be brought below the average rates. Taking them for the expected monthly descent in the Central Shaft, either the thirty feet accomplished in December, or, what is very nearly the same, the average of the four months ending January 1st, the depth then remaining to reach grade—220 feet—is to be accomplished in a little less than eight months, or before September 1 next; and, allowing one month for sinking sump and connecting power pipes, the driving of tunnel headings should be commenced by October 1st. Then, at the average rates of progress of the contract, in West Shaft Heading from January 1, 1870, and in Central Shaft Heading from October 1, 1870, the distance between Central Shaft and West Shaft—which will be the last in time of completion—will be penetrated by December 1, 1873; and allowing, as in a previous calculation, three months time for bringing up unfinished enlargements, laying drains and railway track, &c., final completion of the tunnel for railway trains accomplished by the first day of March, 1874.

I enclose herewith a diagram of the tunnel, showing progress of the past year and total progress up to January 1, 1870.

Very respectfully, your obedient servant,

BENJ'N D. FROST,

*Superintending Engineer.*

On the 3d and 4th of October last, the central and western portions of the Commonwealth were visited with a rain-storm of unparalleled severity, causing great damage to railroads, town roads and bridges, mills and dams, and its effects on the part of the Troy and Greenfield Railroad between Greenfield and the Tunnel were so disastrous that it has not been operated since. Mr. Field, the former State engineer, has furnished the following statement of the damage done:—

“The Troy and Greenfield Railroad was very badly damaged by the October freshet—estimated by myself and others to amount to about \$70,000, (see Report of E. Appleton, Esq., to the governor and council.)

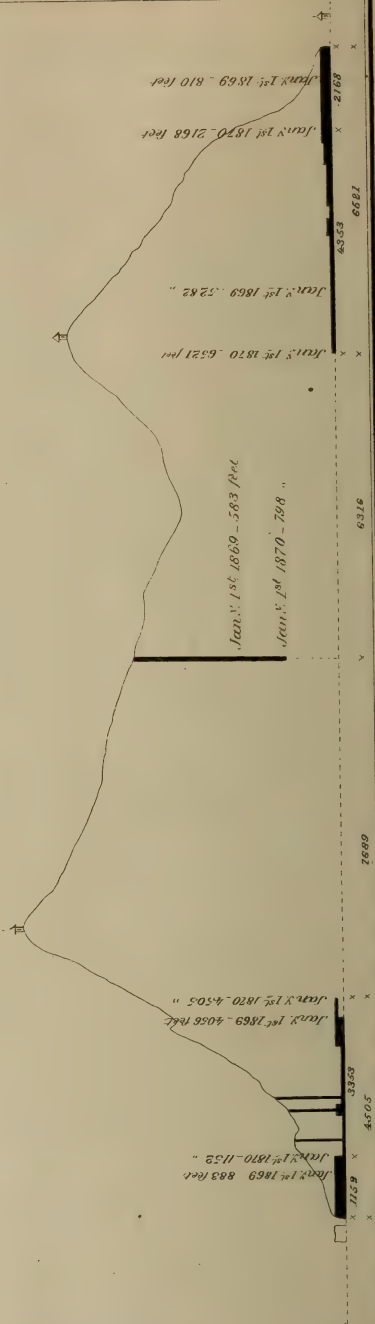
“Many large culverts built by Haupt in 1860, and resisting all the elements up to last October, went out, leaving hardly a trace of them.

“The road for long distances runs close to the banks of the Deerfield River, and the water rising some *four* feet higher than ever before known, not only submerged the track, but washed the em-



# PROFILE OF HOOSAC MOUNTAIN.

Showing Progress of the Tunnel  
up to Jan'y 1st 1870.





bankments badly, as they were not protected so high above all past high-water marks.

“The most serious damage was at the crossing of the Deerfield River, near Bardwell’s Ferry. Here one pier and about three hundred feet of bridging went off; otherwise all the bridging on the road, about 1,800 feet, remains secure.”

Deeming it a matter of public interest to preserve some definite data relating to this storm, we append to this Report a statement of the amount of rain which fell at different points, prepared by a member of the Committee.

The Committee, believing it might be more satisfactory to some of your members to have an exact statement of the progress of the work under the contract up to the first of January last, have obtained from the superintending engineer the following comparative statement of work required by the contract, and of work actually done, by which it appears that the

Value of the items of the work in which the contract requires certain rates of progress to be made, should have been, up to January 1, 1870, . . . . .	\$567,656 37
And the value of the same items actually done up to that date, was . . . . .	467,344 37
	<hr/>
Deficiency in progress in these items to Jan. 1, 1870,	\$100,312 00

We are, however, informed by the engineer, that in the work actually done, there is a much larger proportion of heading than of enlargement than occurs in the full-sized tunnel extension. Under the contract the price is the same for both, although heading costs nearly twice as much as enlargement. Making a fair allowance for this, the engineer informs us, would increase the value of the work done about \$50,000.

The progress of the work at the West End was seriously interrupted by the October freshet, which caused the water in the brook, which formerly crossed the line of the Tunnel, but had been diverted by the State into a canal, to break through the artificial bank into the Tunnel, the water carrying with it great quantities of earth and stone, and entirely filling it in a few

minutes, drowning one man, and the rest escaping with difficulty, and doing damage to the work, as is stated, to an amount somewhat less than \$10,000. This caused an entire suspension of the work at the West End, so far as progress was concerned, for three weeks, and an interruption to the usual rate of progress for a longer period. The progress at other points was also interrupted by the same storm, but to a less extent.

We are informed that the average number of men employed by the contractors during the month of December last, was about seven hundred.

*Comparative Statement of Work required by the Contract, and of Work actually done at the Hoosac Tunnel up to January 1, 1870. Furnished to the Joint Standing Committee of 1869 by BENJAMIN D. FROST, Superintending Engineer.*

Items which may be now included in requirements of progress under the contract.

SECTIONS.	Amounts of Original Estimate.			Contract Time for Completion.	Total Work required to be done up to Jan. 1, 1870, by terms of the Contract.		Amount of Work actually done up to January 1, 1870.	
	Quantities.	Prices.	Amount.		Quantities.	Amount.	Quantities.	Amount.
<i>East End Section.</i>								
Tunnel enlargement, cub. yds., .	4,500	\$16 00	\$72,000 00	May 1, 1872,	1,682	\$26,912 00	3,179	\$50,310 25
Heading enlargement, cub. yds., .	28,000	9 00	252,000 00	Aug. 1, 1872,	5,492	49,428 00	5,796	51,799 00
Tunnel extension, cub. yds., .	85,100	11 00	936,100 00	Feb. 1, 1873,	14,486	158,891 00	9,275	100,988 75
Progress of Heading, lin. ft., .	5,335	-	-	Nov. 1, 1872,	1,152	-	1,239	-
<i>Central Section.</i>								
Tunnel Sinking Shaft, lin. feet, .	447	395 00	176,565 00	May 1, 1870,	282	111,390 00	215	84,234 14
<i>West End Section.</i>								
Heading enlargement, cub. yds., .	52,800	9 75	514,800 00	Mar. 1, 1874,	9,346	90,932 50	13,663	132,509 00
Tunnel extension, cub. yds., .	82,940	12 00	995,280 00	Nov. 1, 1873,	9,570	114,840 00	2,730	32,266 50
Progress of Heading, East, lin. ft.,	5,200	-	-	1, 1873,	-	-	449	-
Brick work, M., . . . .	—4,500	22 00	99,000 00	Mar. 1, 1874,	693 <sup>7.67</sup> / <sub>1000</sub>	15,262 87	691 <sup>2.15</sup> / <sub>1000</sub>	15,206 93
	-	-	\$3,045,745 00		-	\$567,656 37*	-	*\$167,314 37

\* Aggregate of the items of work in which contract now requires average progress.

*Comparative Statement of Work—Concluded.*

Items not now included in requirements of regular progress under the contract.

SECTIONS.	Amounts of Original Estimate.			Contract Time for Completion.	Total Work required to be done up to Jan. 1, 1870, by terms of the Contract.		Amount of Work actually done up to January 1, 1870.	
	Quantities.	Prices.	Amount.		Quantities.	Amount.	Quantities.	Amount.
<i>Amounts brought forward,</i>	.	.	\$3,045,745 00	.	.	.	.	\$467,344 37
<i>East End Section.</i>								
Central drain with pipes, lin. ft.,	5,600	13 00	72,800 00	Feb. 10, 1873,			806	5,961 15
Covering old drain, lin. ft.,	5,500	1 25	6,875 00	Mar. 1, 1874,	-	-	-	-
<i>Central Section.</i>								
Shaft, repairing timber work, lin. ft.,	583	10 00	5,830 00	When ordered,	-	-	583	4,081 00
" trimming, cub yds.,	100	33 00	3,300 00	When ordered,	-	-	83 <sup>7</sup> / <sub>16</sub>	2,762 10
" sinking sump, lin. ft.,	15	395 00	5,920 00	June 1, 1870,	-	-	-	-
" pipes, (2 of 10 in. dia.,)								
lin feet.,	1,030	6 00	6,180 00	June 1, 1870,	-	-	-	1,194 00
Shaft, fire-proof floor and hatches,	-	-	2,000 00	When ordered,	-	-	-	-
Tunnel extension, East, cub. yds.,	35,409	14 00	495,726 00	Sept. 23, 1872,	-	-	-	-
" progress of Heading, East,								
lin. feet.,	2,220	-	-	Sept. 23, 1872,	-	-	-	-
Tunnel extension, West, cub. yds.,	46,861	14 00	656,054 00	July 1, 1873,	-	-	-	-
" progress of Heading, West,								
lin. feet.,	2,938	-	-	July 1, 1873,	-	-	-	-
Central drain with pipes, lin. ft.,	5,158	13 00	67,054 00	Mar. 1, 1874,	-	-	-	-



*West End Section.*

Central drain, with pipes, lin. ft., " " excavation only, lin feet, . . . . .	6,809	\$13 00	\$88,517 00	Mar. 1, 1874,	-	-	1,111	\$13,043 85
Central drain, masonry, lin. ft., . . . . .	1,516	4 35	6,594 00	1, 1874,	-	-	-	-
Covering old drain, lin. feet, . . . . .	1,516	3 00	4,548 00	1, 1874,	-	-	-	-
Stone arch, lin. ft., . . . . .	2,500	1 25	3,125 00	1, 1874,	-	-	-	-
Western façade, . . . . .	50	-	23,000 00	When ordered,	-	-	-	-
Haupt Tunnel, maintenance, . . . . .	-	-	26,000 00	When ordered,	-	-	-	-
Railway track, miles, . . . . .	4 $\frac{3}{4}$	14,000 00	8,500 00	Mar. 1, 1874,	-	-	-	3,833 00
			66,500 00	1, 1874,	-	-	-	-
Total amounts, . . . . .	-	-	\$4,594,268 00		-	-	-	\$498,219 47
Deduct labor and material furnished by Commonwealth, . . . . .								5,830 70
Amount of estimates, . . . . .								\$492,388 77

Aggregate of the items of work in which the contract does not now require average progress, . . . . \$30,875.10

Soon after the great storm, the Committee visited the tunnel a second time. The work at all points on the tunnel was being successfully prosecuted, except at the West End, which was temporarily interrupted by the effects of the flood, no damage having been done to the brick arching, as was reported at the time. At this visit and examination, the Committee saw nothing to change or modify the views already expressed in relation to the work upon their first visit and examination.

The interruption to the travel on the Troy and Greenfield Railroad caused by the flood, has put the people of the western part of Franklin County, and all having business along this line, and particularly the Messrs. Shanly, to great inconvenience.

In conclusion, the Committee would say that they deem it a subject of congratulation and pride that the success of a work of such magnitude, encountering at every step of its progress such obstacles, with such a varied experience from its origin until the present time, should at last be placed beyond a reasonable doubt; that it is as well settled as almost any future event that the Tunnel will be completed for the sum and within the time specified in the contract.

GEO. O. BRASTOW,  
HARRISON TWEED,  
W. GRISWOLD,

*Of the Senate.*

MOSES KIMBALL,  
JAMES B. FRANCIS,  
WARREN WILLIAMS,  
P. AMBROSE YOUNG,  
BENJ. F. COOK,  
CALEB LOMBARD,

*Of the House.*

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A P P E N D I X.

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*Amount of Rain collected in Rain Gauges, at the several stations named, during the Great Storm which ended in Massachusetts on Monday, Oct. 4, 1869, and produced destructive floods in many Rivers in the Eastern part of the United States.*

[Compiled in the office of the Proprietors of the Locks and Canals on Merrimack River, Lowell, Massachusetts, principally from replies to a circular addressed to observers for the Smithsonian Institution at Washington, and others.]

STATION, &c.	County, &c.	Observer or Informant.	TIME.		Depth of rain inches.	Remarks.	
			Commenced raining.	Stopped raining.			
<i>Dominion of Canada.</i>							
Quebec, . . . . .	Quebec, . . . . .	Rev. Father Anthony, . . . . .	Oct. 3, . . . . .	Oct. 5, . . . . .	0.91	{ 2.50 inches of rain fell in 2 hours, Oct. 4, P. M.	
Montreal, . . . . .	Ontario, . . . . .	Louis Lesage, . . . . .	2, . . . . .	4, . . . . .	2.05		
Halifax, . . . . .	Nova Scotia, . . . . .	G. Murdock, . . . . .	- . . . .	- . . . .	1.53		
St John, . . . . .	New Brunswick, . . . . .	G. Murdock, . . . . .	Oct. 4, 6 P. M., . . . . .	Oct. 5, A. M., . . . . .	0.53		
<i>Maine.</i>							
Houlton, . . . . .	Aroostook, . . . . .	C. H. Fernald, . . . . .	Oct. 3, 10 A. M., . . . . .	Oct. 5, 5 P. M., . . . . .	3.61		
Stueben, . . . . .	Washington, . . . . .	J. D. Parker, . . . . .	4, 9 A. M., . . . . .	4, 8 P. M., . . . . .	0.60		
Williamsburg, . . . . .	Piscataquis, . . . . .	E. Pitman, . . . . .	- . . . .	4, . . . . .	5.30		
Orono, . . . . .	Penobscot, . . . . .	M. C. Fernald, . . . . .	Oct. 3, 2.30 P. M., . . . . .	5, 1.30 P. M., . . . . .	2.13		
West Waterville, . . . . .	Kennebec, . . . . .	B. F. Wilbur, . . . . .	3, 6 A. M., . . . . .	4, 6.40 P. M., . . . . .	4.10		
Gardiner, . . . . .	" . . . . .	R. H. Gardiner, . . . . .	- . . . .	- . . . .	3.37		
Lisbon, . . . . .	Androscoggin, . . . . .	A. P. Moore, . . . . .	- . . . .	- . . . .	2.70		
Rumford, . . . . .	Oxford, . . . . .	W. Pettingill, . . . . .	- . . . .	- . . . .	8.00		
Norway, . . . . .	" . . . . .	H. D. Smith, . . . . .	Oct. 3, 6 A. M., . . . . .	- . . . .	6.70		
Standish, . . . . .	Cumberland, . . . . .	J. P. Moulton, . . . . .	- . . . .	- . . . .	4.31		
Fort Preble, Portland, . . . . .	" . . . . .	Dr. E. Cowles, . . . . .	Oct. 3, 5.30 A. M., . . . . .	Oct. 4, 6 P. M., . . . . .	1.99		



Cornish, . . . . .	York, . . . . .	Silas West, . . . . .	Oct. 3, 4 A. M., . . . . .	Oct. 4, 5 P. M., . . . . .	6.43
Cornish, . . . . .	" . . . . .	G. W. Guptill, . . . . .	3, . . . . .	4, . . . . .	6.15
<i>New Hampshire.</i>					
Dover, . . . . .	Strafford, . . . . .	Asa A. Tufts, . . . . .	- . . . .	- . . . .	3.20
North Barnstead, . . . . .	Belknap, . . . . .	Charles H. Pitman, . . . . .	- . . . .	Oct. 4, . . . . .	7.40
Weirs Landing, . . . . .	" . . . . .	Josiah B. French, . . . . .	- . . . .	- . . . .	6.40
Lake Village, . . . . .	" . . . . .	Josiah B. French, . . . . .	- . . . .	- . . . .	6.77
Goffstown, . . . . .	Hillsborough, . . . . .	Alfred Colby, . . . . .	- . . . .	Oct. 4, P. M., . . . . .	8.06
Concord, . . . . .	Merrimack, . . . . .	W. L. Forster, . . . . .	Oct. 2, 12 P. M., . . . . .	4, P. M., . . . . .	7.40
Hanover, . . . . .	Grafton, . . . . .	Shattuck Observatory, . . . . .	3, A. M., . . . . .	4, 5 P. M., . . . . .	5.88
<i>Vermont.</i>					
Lunenburg, . . . . .	Essex, . . . . .	H. A. Cutting, . . . . .	- . . . .	- . . . .	4.00
North Craftsbury, . . . . .	Orleans, . . . . .	Rev. E. P. Wild, . . . . .	Oct. 3, . . . . .	Oct. 5, . . . . .	4.49
Randolph, . . . . .	Orange, . . . . .	C. S. Paine, . . . . .	- . . . .	4, . . . . .	5.28
Burlington, . . . . .	Chittenden, . . . . .	University of Vermont, . . . . .	Oct. 3, . . . . .	5, A. M., . . . . .	3.71
West Charlotte, . . . . .	" . . . . .	Miss M. E. Wing, . . . . .	- . . . .	5, 9.15 A. M., . . . . .	5.00
Panton, . . . . .	Addison, . . . . .	D. C. Barto, . . . . .	- . . . .	- . . . .	4.25
Middlebury, . . . . .	" . . . . .	H. A. Sheldon, . . . . .	Oct. 3, 6 A. M., . . . . .	Oct. 5, 11 A. M., . . . . .	3.98
Castleton, . . . . .	Rutland, . . . . .	Rev. R. G. Williams, . . . . .	3, 4 A. M., . . . . .	5, 1 P. M., . . . . .	6.57
Woodstock, . . . . .	Windsor, . . . . .	H. Doton, . . . . .	3, 6 A. M., . . . . .	4, 5 P. M., . . . . .	6.35
<i>Massachusetts.</i>					
Kingson, . . . . .	Plymouth, . . . . .	G. S. Newcomb, . . . . .	- . . . .	Oct. 4, . . . . .	1.75
New Bedford, . . . . .	Bristol, . . . . .	Samuel Rodman, . . . . .	Oct. 3, 8 P. M., . . . . .	4, 4.30 P. M., . . . . .	1.50
Milton, . . . . .	Norfolk, . . . . .	Rev. A. K. Teele, . . . . .	- . . . .	- . . . .	1.15

{ 4.27 inches of rain fell between 11  
A. M. and 2 P. M., Oct. 4.  
4.00 inches of rain fell between 0.30  
P. M. and 2.30 P. M., Oct. 4.  
}

*Amount of Rain collected in Rain Gauges at the several stations named, during the Great Storm, &c.—Continued.*

STATION, &c.	County, &c.	Observer or Informant.	TIME.		Depth of rain, inches.	Remarks.
			Commenced raining.	Stopped raining.		
West Roxbury, . . . .	Norfolk, . . . .	Thomas Motley, . . . .	-	-	1.46	
Jamaica Plain, . . . .	" . . . .	J. J. Dixwell, . . . .	Oct. 3, . . . .	Oct. 4, . . . .	1.45	
Fort Warren, . . . .	Boston Harbor, . . . .	Dr. J. H. Kinsman, . . . .	-	-	0.90	
Boston, . . . .	Suffolk, . . . .	W. H. Bradley, . . . .	Oct. 3, . . . .	Oct. 4, . . . .	1.76	
Boston, . . . .	" . . . .	Robert Treat Paine, . . . .	3, . . . .	4, . . . .	1.52	
Topsfield, . . . .	Essex, . . . .	S. A. Merriam, . . . .	-	4, . . . .	1.77	
Georgetown, . . . .	" . . . .	S. A. Nelson, . . . .	Oct. 3, 0.10 P. M., . . . .	4, 6 P. M., . . . .	2.25	
Lawrence, . . . .	" . . . .	John Fallon, . . . .	3, 12 M., . . . .	4, 4.30 P. M., . . . .	3.56	
Cambridge, . . . .	Middlesex, . . . .	Harvard College Obs'y, . . . .	3, . . . .	4, . . . .	1.58	
Waltham, . . . .	" . . . .	I. R. Scott, . . . .	-	-	1.65	
West Newton, . . . .	" . . . .	J. H. Bixby, . . . .	-	-	2.23	
Lake Cochituate, . . . .	" . . . .	A. Stanwood, . . . .	-	-	4.00	
Lowell, . . . .	" . . . .	Merrimack Manuf. Co., . . . .	-	-	3.02	
Lowell, . . . .	" . . . .	Prop's Locks Canals, . . . .	-	-	2.84	
Lunenburg, . . . .	Worcester, . . . .	G. A. Cunningham, . . . .	Oct. 3, . . . .	Oct. 4, . . . .	7.60	{ About 3 inches of rain fell betw'n 11.30 A.M. and 2 P.M., Oct. 4. Rain Gauge overflowed. Rain Gauge overflowed.
Fitchburg, . . . .	" . . . .	Dr. Jabez Fisher, . . . .	3, . . . .	4, . . . .	7.53	
Worcester, . . . .	" . . . .	Dr. Joseph Draper, . . . .	-	4, . . . .	4.75+	
Amherst College, . . . .	Hampshire, . . . .	Prof. E. S. Snell, . . . .	Oct. 3, . . . .	4, . . . .	5.83+	
Chicopee, . . . .	Hampden, . . . .	C. H. Nye, . . . .	-	-	8.71	

Springfield,	Hampden,	L. C. Allen, U. S. Armory,	Oct. 3, 2 A. M.,	Oct. 4, 3.15 P. M.,	8.05
Springfield,	"	J. Weatherhead, . . .	-	4,	7.50
Hinsdale,	Berkshire,	Rev. E. Dewhurst,	Oct. 3,	-	6.80
Pittsfield,	"	Thos. Colt, . . .	-	Oct. 4,	6.00
Williams College,	"	Prof. A. Hopkins,	-	-	6.00
Richmond,	"	Wm. Bacon,	Oct. 3, 3 P. M.,	Oct. 4, 3 P. M.,	3.97
{ More than one-half the quantity fell betw'n 8 A. M. and 11 A. M., Oct. 4.					
Fort Adams,	Rhode Island.	-	Oct. 3, 8.40 P. M.,	Oct. 4, 10.30 A. M.,	0.90
Providence,	Providence,	Dr. Caswell,	-	-	0.83
{ In reply to the Circular, Mr. Case says: "I measured 12.35 inches, but I do not think it could possibly have been so much. I think there was an unaccountable mistake somewhere."					
Hartford,	Hartford,	Prof. Pynchon,	-	-	8.43
Hartford,	"	C. H. Hoadly,	-	Oct. 4, 3 P. M.,	8.11
Canton,	"	Geo. I. Case,	-	-	-
{ Rain Gauge overflowed.					
New Haven,	New Haven,	Prof. Loomis,	-	-	4.30+
New Haven,	"	Dr. Munson,	-	-	6.00+
Middletown,	Middlesex,	Prof. Johnston,	Oct. 3,	Oct. 4,	8.90
Middletown,	"	H. D. A. Ward,	3,	4,	9.37
Colebrook,	Litchfield,	Miss C. Rockwell,	3, 3 A. M.,	4, 9 P. M.,	8.44
Brookfield,	Fairfield,	Rev. I. W. Roe,	-	-	5.50
{ The whole amount fell in a little more than 30 hours.					
Moriches,	Suffolk,	E. E. Smith,	Oct. 3, 8.50 A. M.,	Oct. 4, 1.30 P. M.,	5.34
Fort at Willets Point,	Queens,	Gen'l H. L. Abbot,	3, 12 P. M.,	4, 1 P. M.,	7.85
Flatbush,	Kings,	Rev. E. T. Mack,	2, 9.30 P. M.,	4, P. M.,	3.46
{ P. M., Oct. 3, and 2 P. M., Oct. 4.					

*Amount of Rain collected in Rain Gauges at the several stations named, during the Great Storm, &c.—Continued.*

STATION, &c.	County, &c.	Observer or Informant.	TIME.		Depth of rain, inches.	Remarks.
			Commenced raining.	Stopped raining.		
Fort Schuyler, . . . .	Westchester, .	Gen <sup>l</sup> H. L. Abbot, . .	-	-	8.00	
City Hall Park, . . . .	New York, . .	Croton Aqueduct Dept., .	Oct. 3, 11 P. M., .	Oct. 4, 12 M., .	4.11	
Central Park, . . . .	" . . . .	Central Park Com., . .	-	-	3.92	
New Reservoir, 86th st., .	" . . . .	Croton Aqueduct Dept., .	-	Oct. 4, . . . .	4.09	
High Bridge, . . . .	" . . . .	Croton Aqueduct Dept., .	-	4, . . . .	4.50	
Tarrytown, . . . .	Westchester, .	Croton Aqueduct Dept., .	-	4, . . . .	4.45	
Croton Dam, . . . .	" . . . .	Croton Aqueduct Dept., .	-	4, . . . .	5.10	
Kent, . . . .	Putnam, . .	Croton Aqueduct Dept., .	-	4, . . . .	5.23	
Ardenia, . . . .	" . . . .	T. B. Arden, . . . .	-	-	4.63	
West Point, . . . .	Orange, . .	J. Müller, Hospital Stew'd.,	-	Oct. 4, 11.30 A. M.,	5.25	
Newburgh, . . . .	" . . . .	Jas. H. Gardiner, . .	-	-	5.30	
Middlehope, . . . .	" . . . .	Leander Clark, . . .	-	-	4.77	
Glaseo, . . . .	Ulster, . .	D. B. Hendricks, . .	-	-	4.75	
Hudson, . . . .	Columbia, .	Dr. G. P. Hachenberg, .	-	-	7.90	
Albany, . . . .	Albany, . .	Prof. Ten Eyck, . . .	Oct. 3, . . . .	Oct. 5, . . . .	6.01	
Albany, . . . .	" . . . .	Dudley Observatory, . .	3, 5.30 P. M.,	4, 12 M., .	5.86	
Troy, . . . .	Rensselaer, .	Water Commissioners, .	3, . . . .	5, . . . .	5.46	
South Hartford, . . . .	Washington, .	G. M. Ingalsbe, . . .	3, 1 P. M., .	5, 3 P. M., .	5.89	
Plattsburgh Barracks, . .	Clinton, . .	Maj.-Gen. Arnold, . .	3, 1 A. M., .	5, 8 P. M., .	3.01	



Minville, . . . . .	Montgomery, . . . . .	J. W. Bussing, . . . . .	Oct. 3, . . . . .	Oct. 4, 9.30 A. M., . .	5.25
South Trenton, . . . . .	Oneida, . . . . .	Storrs Barrows, . . . . .	1, . . . . .	4, . . . . .	2.28
Leyden, . . . . .	Lewis, . . . . .	C. C. Merriam, . . . . .	2, . . . . .	4 P. M., . . . . .	3.60
Houseville, . . . . .	" . . . . .	Walter D. Yale, . . . . .	3, . . . . .	5, 8 A. M., . . . . .	2.02
Gouverneur, . . . . .	St. Lawrence, . . . . .	C. H. Russell, . . . . .	2, . . . . .	5, A. M., . . . . .	2.87
North Hammond, . . . . .	" . . . . .	C. A. Wooster, . . . . .	2, 6.20 P. M., . . . .	5, A. M., . . . . .	3.35
Oneida, . . . . .	Madison, . . . . .	Dr. S. Spooner, . . . . .	3, . . . . .	4, . . . . .	5.84
Palermo, . . . . .	Oswego, . . . . .	E. B. Bartlett, . . . . .	- . . . . .	5, A. M., . . . . .	2.70
Oswego, . . . . .	" . . . . .	W. S. Malcolm, . . . . .	- . . . . .	- . . . . .	2.15
Depauville, . . . . .	Jefferson, . . . . .	Henry Haas, . . . . .	Oct. 4, 6 A. M., . . . .	Oct. 4, 3 P. M., . . . .	2.60
Newark Valley, . . . . .	Tioga, . . . . .	Rev. S. Johnson, . . . . .	2, 5 P. M., . . . . .	5, . . . . .	2.80
<i>New Jersey.</i>					
Paterson, . . . . .	Passaic, . . . . .	Wm. Brooks, . . . . .	Oct. 3, . . . . .	Oct. 4, . . . . .	4.15
Newark, . . . . .	Essex, . . . . .	Wm. A. Whitehead, . . . .	3, 0 A. M., . . . . .	4, 12 M., . . . . .	3.33
Newton, . . . . .	Sussex, . . . . .	Dr. T. Ryerson, . . . . .	3, 3 A. M., . . . . .	5, 8.30 A. M., . . . .	7.11
New Germantown, . . . . .	Hunterdon, . . . . .	Arthur B. Noll, . . . . .	3, 5 A. M., . . . . .	3, 8.30 P. M., . . . .	4.43
Trenton, . . . . .	Mercer, . . . . .	E. R. Cook, . . . . .	- . . . . .	4, . . . . .	2.61
Haddonville, . . . . .	Camden, . . . . .	John Boadle, . . . . .	- . . . . .	4, . . . . .	3.32
Vineland, . . . . .	Cumberland, . . . . .	Dr. J. Ingram, . . . . .	Oct. 3, 5 A. M., . . . .	4, 10 A. M., . . . . .	2.87
Greenwich, . . . . .	" . . . . .	Rebecca C. Sheppard, . . . .	3, . . . . .	4, . . . . .	3.25
Rio Grande, . . . . .	Cape May, . . . . .	Mrs. J. R. Palmer, . . . . .	- . . . . .	4, . . . . .	3.50
Moorestown, . . . . .	Burlington, . . . . .	Thos. J. Beans, . . . . .	Oct. 3, 9 A. M., . . . .	4, 8 A. M., . . . . .	2.41
<i>Pennsylvania.</i>					
Nyces, . . . . .	Pike, . . . . .	John Grathwohl, . . . . .	Oct. 3, 4 A. M., . . . .	Oct. 4, 8 A. M., . . . .	7.50

{ 5.21 inches of rain fell betw'n Oct.  
3, 4.30 P. M., and Oct. 4, 9 A. M.

*Amount of Rain collected in Rain Gauges at the several stations named, during the Great Storm, &c.—Concluded.*

STATION, &c.	County, &c.	Observer or Informant.	TIME.		Depth of rain, inches.	Remarks.
			Commenced raining.	Stopped raining.		
Hamilton, . . . . .	Wayne, . . . . .	J. D. Stocker, . . . . .	Oct. 1, . . . . .	Oct. 3, 6 A. M., . . . . .	6.00	{ 3 inches of rain fell during the night of Oct. 3.
Dyberry, . . . . .	" . . . . .	Theodore Day, . . . . .	3, . . . . .	4, 9 A. M., . . . . .	4.15	
Fallsington, . . . . .	Bucks, . . . . .	E. Hance, . . . . .	3, 8 A. M., . . . . .	4, 11 A. M., . . . . .	2.90	
Horsham, . . . . .	Montgomery, . . . . .	Miss Anna Spencer, . . . . .	- . . . .	4, . . . . .	4.00+	Rain Gauge overflowed.
Plymouth Meeting, . . . . .	" . . . . .	M. H. Corson, . . . . .	Oct. 3, 6 A. M., . . . . .	4, 10-30 A. M., . . . . .	6.00	
Pennsylvania Hospital, . . . . .	Philadelphia, . . . . .	Dr. Conrad, . . . . .	3, . . . . .	4, 10-30 A. M., . . . . .	3.85	
Cor. 7th & Thompson sts., . . . . .	" . . . . .	Jacob M. Ellis, . . . . .	2, P. M., . . . . .	4, 9 A. M., . . . . .	4.25	{ Rain Gauge filled to within $\frac{1}{2}$ inch of top; probably a portion lost by splashing over.
Western part of city, . . . . .	" . . . . .	Jacob M. Ellis, . . . . .	- . . . .	- . . . .	3.75	
Germantown, . . . . .	" . . . . .	Jacob M. Ellis, . . . . .	- . . . .	- . . . .	5.20	
Westchester, . . . . .	Chester, . . . . .	Dr. George Martin, . . . . .	- . . . .	- . . . .	3.75	{ Rain Gauge out of order. Rain-fall stated to be between 8 and 9 inches.
Westchester, . . . . .	" . . . . .	Dr. Jesse C. Green, . . . . .	- . . . .	- . . . .	5.80	
Parkerville, . . . . .	" . . . . .	Dr. F. Darlington, . . . . .	Oct. 3, A. M., . . . . .	Oct. 4, 10 A. M., . . . . .	5.24	
Phenixville, . . . . .	" . . . . .	Dr. J. Z. Coffman, . . . . .	- . . . .	- . . . .	7.10	{ Rain Gauge out of order. Rain-fall stated to be between 8 and 9 inches.
Reading, . . . . .	Berks, . . . . .	J. Heyl Raser, . . . . .	Oct. 3, 3.15 A. M., . . . . .	Oct. 4, A. M., . . . . .	6.73	
Ephrata, . . . . .	Lancaster, . . . . .	W. H. Spera, . . . . .	2, 11.35 A. M., . . . . .	4, 4 A. M., . . . . .	8.05	
Mount Joy, . . . . .	" . . . . .	Dr. J. R. Hoffer, . . . . .	- . . . .	- . . . .	-	{ Rain Gauge out of order. Rain-fall stated to be between 8 and 9 inches.
Factoryville, . . . . .	Wyoming, . . . . .	Rodman Sisson, . . . . .	Oct. 3, 1 A. M., . . . . .	Oct. 4, . . . . .	4.67	
Tioga, . . . . .	Tioga, . . . . .	E. T. Bentley, . . . . .	2, 10 P. M., . . . . .	- . . . .	2.00	
Lewisburg, . . . . .	Union, . . . . .	Prof. C. S. James, . . . . .	- . . . .	- . . . .	3.60	

Carlisle, . . . . .	Cumberland, . . . . .	Dr. W. H. Cook, . . . . .	Oct. 2, 1 P. M., . . . . .	Oct. 4, 2 A. M., . . . . .	4.50
Fountain Dale, . . . . .	Adams, . . . . .	S. C. Walker, . . . . .	2, 2.30 P. M., . . . . .	4, 3 A. M., . . . . .	4.58
Grampian Hills, . . . . .	Clearfield, . . . . .	Elisha Fenton, . . . . .	2, 10 P. M., . . . . .	- . . . .	0.57
Johnstown, . . . . .	Cambria, . . . . .	David Peelor, . . . . .	2, 7 P. M., . . . . .	Oct. 3, 9 A. M., . . . . .	0.76
Franklin, . . . . .	Venango, . . . . .	Rev. M. A. Tolman, . . . . .	2, 3.30 P. M., . . . . .	5, 3.30 P. M., . . . . .	0.47
Canonsburg, . . . . .	Washington, . . . . .	W. Smith, . . . . .	2, . . . . .	4, . . . . .	1.40
<i>Delaware.</i>	Kent, . . . . .	Mrs. A. C. Whittier, . . . . .	- . . . .	- . . . .	1.50
<i>Maryland.</i>					
Woodlawn, . . . . .	Cecil, . . . . .	J. O. McCormick, . . . . .	Oct. 2, . . . . .	Oct. 4, 5 A. M., . . . . .	3.97
Annapolis, . . . . .	Anne Arundel, . . . . .	W. R. Goodman, . . . . .	2, 11.30 P. M., . . . . .	4, 6.20 A. M., . . . . .	5.25
Mount St. Mary's, . . . . .	Frederick, . . . . .	Prof. C. H. Jourdan, . . . . .	- . . . .	4, . . . . .	5.12
<i>District of Columbia.</i>					
Washington, . . . . .	Washington, . . . . .	Smithsonian Institution, . . . . .	Oct. 3, A. M., . . . . .	Oct. 4, A. M., . . . . .	6.55
<i>Virginia.</i>					
Johnsontown, . . . . .	Northampton, . . . . .	C. R. Moore, . . . . .	Oct. 3, 6.30 P. M., . . . . .	Oct. 4, A. M., . . . . .	1.05
Comorn, . . . . .	King George, . . . . .	E. Tayloe, . . . . .	2, day break, . . . . .	4, 7 P. M., . . . . .	5.42
Fortress Monroe, . . . . .	Elizabeth City, . . . . .	Artillery School, U. S. A., . . . . .	2, . . . . .	3, . . . . .	1.98
Hampton, . . . . .	" . . . . .	J. M. Sherman, . . . . .	2, 4 A. M., . . . . .	4, 5 A. M., . . . . .	3.30
Zuni Station, . . . . .	Isle of Wight, . . . . .	R. Binford, . . . . .	2, 11 A. M., . . . . .	3, 2 A. M., . . . . .	3.16
Bacon's Castle, . . . . .	Surry, . . . . .	B. W. Jones, . . . . .	3, 8 A. M., . . . . .	4, A. M., . . . . .	3.80
Staunton, . . . . .	Augusta, . . . . .	J. C. Covell, . . . . .	- . . . .	4, . . . . .	2.25
Lexington, . . . . .	Rockbridge, . . . . .	W. H. Ruffner, . . . . .	Oct. 2, A. M., . . . . .	3, 4.30 P. M., . . . . .	2.75
Snowville, . . . . .	Pulaski, . . . . .	J. W. Stalmaker, . . . . .	2, 7 P. M., . . . . .	- . . . .	1.20

{ 5.05 inches of rain fell October  
3d, between daybreak and mid-  
night.





SENATE....No. 55.

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Commonwealth of Massachusetts.

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To the Honorable H. H. COOLIDGE, *President of the Senate.*

SIR :—I have the honor herewith to transmit the Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel for the year 1870.

With great respect,  
I have the honor to be,  
Your obedient servant,

GEORGE M. BUTTRICK.

FEBRUARY 6, 1871.

## Commonwealth of Massachusetts.

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### REPORT.

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The Committee on the Hoosac Tunnel and Troy and Greenfield Railroad, since the adjournment of the legislature, have made a thorough examination of the work of repairs upon the Troy and Greenfield Railroad ; also of all parts of the work upon the Tunnel.

#### *Troy and Greenfield Railroad from Greenfield to the Hoosac Tunnel.*

During the past year the repairs upon the railroad, made necessary by the extraordinary freshet of October, 1869, have been completed.

They had been so far advanced by July 4, 1870, as to permit the occupation of the road under special conditions of carefulness, but the final completion of the work undertaken was not accomplished until late in the autumn.

The examinations by the engineers employed in this duty developed in many places the necessity for much more extensive and thorough work of rebuilding than had previously been thought necessary.

This necessity proceeded in some degree from imperfections and deficiencies in original construction, but more especially

from the exceptional trials to which the works were subjected, and from new conditions which were created.

The extraordinary rise of the Deerfield River with its abrading effect upon the banks along which the road extends, created new points of exposure, and new requirements for future protection.

The conditions above stated have involved an amount of expenditure largely exceeding that which had been previously contemplated on the part of the agents of the Commonwealth, or of the railroad companies, lessees of the road.

Nearly the whole of this excess is for improved construction, which, under ordinary circumstances, would not demand or receive the attention of the lessees of the road, but which the Commonwealth, having direct pecuniary interest in the value and permanence of its property, should properly take cognizance of.

*Highway across the lands of the Commonwealth near the east end of the Tunnel.*

Chapter 252 of Acts of 1870, by sections one and two, authorized the expenditure of \$100,000 for the repairs of the Troy and Greenfield Railroad ; also, by section three, it allowed the amount of fifteen hundred dollars (\$1,500) to be expended in such manner as the governor and council should determine towards the cost of making a highway across the lands of the Commonwealth near the east end of the tunnel. The governor and council have provided for the construction of this highway upon the route laid out by the county commissioners of Berkshire County, and a length of forty-eight (48) rods of the road was so nearly completed during the year 1870 as to be now open for travel.

*Hoosac Tunnel.*

The operations of the past year seem to have been conducted with a reasonable degree of success, and with much less hindrance from exceptional circumstances than attended the workings of the year previous.

This is in part to be attributed to the favorable nature of the season, but it is proper to state that the outside works initiated

last year, and continued during the present season have added to the security against interruption.

At the east end section the machinery for compressing air by steam power, set up by the contractors last year, has this year been brought into successful operation.

Thus far it has been employed only as auxiliary or supplementary to the force of Deerfield River, and has been resorted to only when low water, anchor ice or disarrangement of machinery had diminished or cut off the supply of power from that source.

In this way it has proved very valuable in many instances, enabling the continuance of full progress at the forward heading, when, by occurrence of such contingencies as have been alluded to, it would have been retarded or entirely stopped.

It is purposed, as we are informed, very shortly to bring steam compressors into use, for the supplying of power to drive the work of *enlargement* by machine drills.

The work has hitherto been done only by hand-power, but applied in this way they will become an additional element of progress.

#### *Central Shaft.*

Various contingencies and sources of delay have prevented the advance which had been reasonably calculated upon at this point.

These, however, have been successively met and overcome.

The shaft has been sunk to grade, the work of excavating the tunnel east and west has been commenced, and a small distance advanced in each direction previous to January 1, 1871.

The necessary steam-power air-compressors, machinery, pumps, &c., are already placed, and are in complete working order.

And we are informed that the pneumatic drills, drill-carriages and other additional apparatus for drilling by machinery will be introduced as soon as progress by hand labor has opened a space large enough for their safe and convenient employment.

#### *West End Section.*

During the early part of the year the progress in the heading east of the west shaft was, in consequence of the rock encoun-



tered, slow, falling behind the rate which was originally contemplated by the contract.

The workings, however, have been industriously prosecuted, and the present rate considerably exceeds the standard above referred to.

The brick arch through soft veins of rock at west end is being carried forward in a thorough and substantial manner, under the charge of experienced and careful men.

The contingencies which have at times arisen are such as are not unusual in the progress of similar undertakings, and are not such as to impair confidence in the security and permanence of the finished work.

For more particular explanation of the relative progress made at the different points of working, and of the circumstances which may govern our expectation of the final completion, we include in our Report the following communication and diagram received from the State Engineer:—

ENGINEER'S OFFICE, HOOSAC TUNNEL, }  
NORTH ADAMS, MASS., Jan. 28, 1871. }

*To the Joint Standing Committee for the year 1870 on the Troy and Greenfield Railroad and Hoosac Tunnel:*

In response to your request, I have the honor to transmit to you the following brief statement concerning the operations and progress of this work up to December 31, 1870.

This includes a term of two years from the date of execution of the contract; but it must be remembered, in the deduction of any conclusions from the comparison of time elapsed with advance already made, that the work of excavating the tunnel was not commenced at any point until three months afterward, and that the application of full forces at all the breasts of working was not accomplished until a yet later date.

At the governing points of advance, the earliest excavations under the contract with F. Shanly & Co. were commenced as follows:—

East end heading, . . . . .	March 29, 1869.
Sinking central shaft, . . . . .	May 20, 1869.
West end heading, . . . . .	July 2, 1869.

The remembrance of these dates of commencement, and of the twenty-four days, or four-fifths of a month delay at the west end

heading, caused by the freshet of October, 1869, will tend to a better apprehension of the relative accomplishment made in the period of actual working.

The aggregate distances advanced, and value of work done under Shanly's contract, separately stated for the years 1869 and 1870, are shown by the following,—

*Comparative Statement of Work done during the years 1869 and 1870, and of work remaining to be done under F. Shanly & Co.'s Contract for completion of Hoosac Tunnel.*

	Work done in 1869.	Work done in 1870.	Work to be Done.	Whole Amount of Contract.
Lineal feet of Headings, . . . . .	1,688	2,864	11,141	15,693
Value of Tunnel Work, . . . . .	\$405,918 23	\$715,680 96	\$3,206,343 81	\$4,327,973 00
Lineal feet of Shaft to grade, . . . . .	215	230	2	447
Value of all Shaft Work, . . . . .	92,271 24	94,223 67	13,300 09	199,795 00
Railway Track, . . . . .	—	—	66,500 00	66,500 00
Deduct work and material furnished by State,	\$498,219 47	\$809,904 63	\$3,286,143 90	\$4,594,268 00
Amount of Work by F. Shanly & Co, .	5,830 70	2,573 10		
	\$492,388 77	\$807,331 53		

During the past year the headings at east and west ends have made a nearly continuous advance, no considerable interruption having been sustained, and the progress may be deemed a fair exhibit of what could be accomplished with the means at command, in view of the nature of material encountered.

The sinking of the central shaft reached grade August 12, and the workings at the bottom of the shaft were temporarily suspended the next day, August 13.

The last of these workings while descending through the height of the tunnel, had been made to include horizontal lengths of sixteen feet, respectively, east and west of the shaft, or a full length of thirty-two feet taken out to the full size of the tunnel.

Between August 13 and October 25—two and four-tenths months—was employed in the work of trimming sides of shaft, and of repairing and strengthening the timbering and guides, with the aim of preparing these, in a permanent fashion, for the more severe and continuous trials to which they would be exposed in the prosecution of the work of tunnel extension—in the overhauling and repair of the hoisting engine—and also in the removal of the pipes and pumping machinery provided by the State, which were used while making the shaft, and the replacing them by mains and pumps of larger capacity.

This last item of work, involving very considerable time and expense, might have been deferred if the object had been to make the greatest exhibit of the immediate progress, but was more profitably accomplished at this time, with a less amount of actual delay than would have attended a separate stoppage afterward when the immediate necessity should be encountered.

On the 25th of October work on tunnel extension at the bottom of the central shaft was resumed and continued until the night of December 7, when the breaking of some teeth from the gear, and the derangement of the hoisting machinery caused thereby, made necessity for repairs which occupied until midnight of December 25. At that time, hoisting of water which had then accumulated to the depth of fifty-four feet, was commenced and occupied till January 3, at which date work at the headings, east and west from the shaft, was again put under way.

It will thus appear that during the work of the year 1870 at the central shaft, two and four-tenths months, between August 13 and October 25, were devoted to the completion of the excavation on the sides of the shaft, repairs of timbering and machinery, and to replacing the pumping equipment; the greater part of this being in items of preparation necessary to future operations, but for which



the contract provides no separate compensation, and that for the eight-tenths of a month following December 7, no advance was made.

The contract prescribing average rates of progress, does not undertake to provide for exceptional circumstances which compel a temporary change from its conditions.

The deficiency at the central section of the amount done, as compared with the amount required by the terms of the contract, appearing up to January 1, 1870, as \$27,155.86, has been increased under the operation of the conditions heretofore described so as to become: total up to January 1, 1871, \$245,466.84, or nearly two-thirds of the amount of the deficiency on the whole work of the tunnel up to the date as shown on the comparative statement in detail which I supply, at your suggestion, to be annexed to your report.

The total lengths opened by the State, and the allowances made by contractors, separately stated for the years 1869 and 1870, in sinking the central shaft or in progress at the several headings, and also the distances yet to be penetrated from January 1, 1871, appear on the following tabulated statement:—

HEADINGS.	DISTANCES PENETRATED.				Lengths remaining to be Penetrated.
	By State, to January 1, 1869.	By F. SHANLY & Co.		Aggregate done to Jan. 1, 1871.	
		In 1869.	In 1870.		
East End Section, . .	5,282	1,239	1,514	8,035	4,742
Central Section, { East, .	-	-	60	60	
	West, .	-	87	87	6,399
West End Section, . .	4,056	449	1,203	5,708	
Aggregate of Headings, .	9,338	1,688	2,864	13,890	11,141
Central Shaft* (depth), .	583	215	230	1,028	2

\* 1,028 feet to grade.

The main interest in the details of past performance, consists in their affording the data from which to form our expectation of future operations.

In my letter of February 5, 1870, which was included in your report rendered during that month by the committee for 1869, I made an estimate of future progress, mainly based on the original rates computed for the contract; and it is a matter of interest to remark that this has been closely approximated in most of its details, by the dates and by the amounts of the work actually accomplished during the year ending December 31, 1870.

I give the statement as follows:—

	Estimated.	Actual.
East End Section. Lengths of Heading, . .	1,500 lin. ft.	1,514 lin. ft.
Central Shaft. Time of reaching grade, . .	Sept. 1, .	August 12.
“ “ Time of commencing Headings, . .	Oct. 1, .	October 25.
“ “ Aggregate length of Headings, . .	480 lin. ft.	147 lin. ft.
West End Section. Length of Headings, . .	1,200 “	1,203 “

In the single item, that of heading from the central shaft, where deficient progress appears, the causes of exceptional delay have been already stated, with the fact that a portion of these were undertaken for the purpose of securing a more continuous and uninterrupted working in the future.

Starting from the actual advance made up to January 1, 1871, and making the computation of future progress upon the same basis as taken for my last year's estimate, the expected date for the completion of the tunnel would appear to be March 15, 1874; but the fact that the workings of the last three months of 1870, in the headings where machine drills were employed, show an aggregate progress considerably in advance of that which the original contract stipulations would require, and the existence of other favoring conditions for future advance, warrant the belief that the work will be finished at an earlier date.

I enclose herewith a diagram of the tunnel, showing the whole progress made up to January 1, 1871.

Very respectfully, your obedient servant,

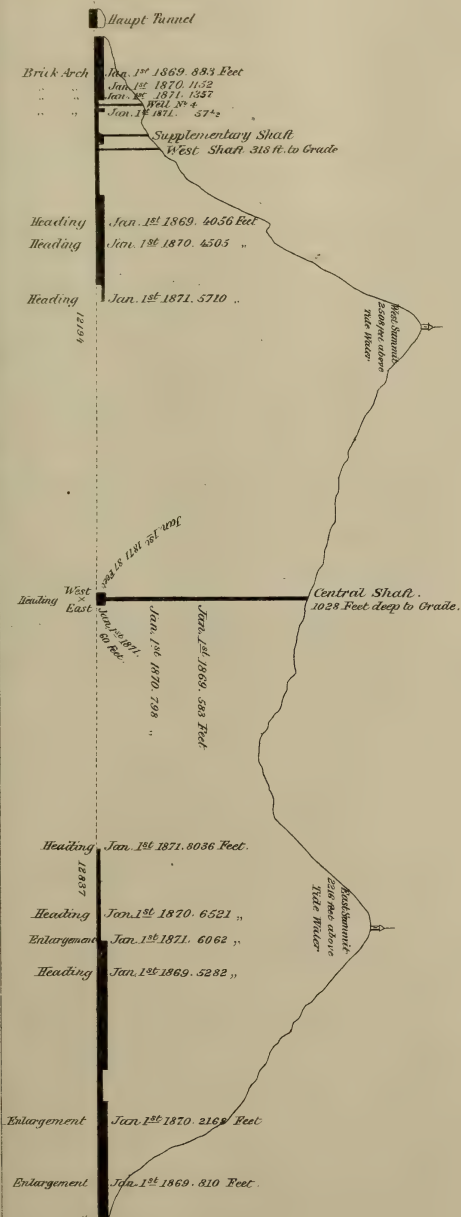
BENJ'N D. FROST.

# PROFILE

OF

## HOOSAC MOUNTAIN.

Showing Progress of the Tunnel  
up to Jan. 1st 1871.







From the foregoing statement it will appear that the present shortcomings and special hindrances which have been encountered, do not conflict with the expectation entertained by the contractors of finishing the tunnel in advance of the date to which they are limited by the contract.

In order to give an exact record of the actual progress made, as compared with the requirements of the contract up to the end of the year 1870, the Committee have obtained from the State engineer of the tunnel the comparative statement of the work required by the contract, and of the work already done, by which it will appear that the value of the items of work undertaken or completed to which requirements are or have been attached should have been, up to Jan'y 1, 1871, \$1,667,827 66 And value of said items actually done up to that

date was,	.	.	.	.	.	.	.	1,308,124 10
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Deficiency in progress in the items to Jan. 1, 1871, \$359,703 56

Of this deficiency it is proper to state that \$245,466.84, or more than two-thirds of the whole amount, is upon the central section, where so many difficulties and hindrances have occurred.

## COMPARATIVE STATEMENT

*Of Work required by the Contract, and of Work actually done at the Hoosac Tunnel, up to January 1, 1871.*

[Furnished to the Joint Standing Committee of 1870 by BENJAMIN D. FROST, State Engineer at the Tunnel.]

## ITEMS WHICH MAY BE NOW INCLUDED IN REQUIREMENTS OF PROGRESS UNDER THE CONTRACT.

SECTIONS.	Amounts of Original Estimate.			Contract time for Completion.		Total work required to be done to Jan. 1, '71, by terms of contract.		Amount of Work Actually Done up to Jan. 1, 1871.	
	Quantities.	Prices.	Amount.			Quantities.	Amount.	Quantities.	Amount.
<i>East End Section.</i>									
Tunnel Enlargement,*	4,500	\$16 00	\$72,000 00	May 1, 1872,	2,882	\$46,264 46	3,836		\$60,578 50
Heading Enlargement,*	28,000	9 00	252,000 00	Aug. 1, 1872,	14,204	127,844 82	23,328		208,733 25
Tunnel Extension,*	85,100	11 00	936,100 00	Feb. 1, 1872,	37,382	411,020 24	26,664		291,287 75
Progress of Heading,†	5,335	-	-	-	2,652	-	2,753		-
Central Drain with Pipes,†	5,600	13 00	72,800 00	Feb. 10, 1873,	2,152	25,286 00	1,422		11,224 95
<i>Central Section.</i>									
Shaft repairing Timber,†	583	10 00	5,830 00	When ordered,	583	5,830 00	583		5,247 00
Trimming,*	100	33 00	3,300 00	When ordered,	100	3,300 00	90, <sup>78</sup> <sub>105</sub>		2,995 74
Sinking,†	447	395 00	176,565 00	May 1, 1870,	447	176,565 00	445		174,811 17
Pipes,†	1,030	6 00	6,180 00	June 1, 1870,	1,030	6,180 00	647		1,941 00
Fire Proof Floor and Hatches,	-	-	2,000 00	When ordered,	-	2,000 00	-		1,500 00
Tunnel Extension, East,*	35,409	14 00	495,726 00	Sept. 22, 1872,	8,967	125,538 60	395		5,314 00
Progress of Heading,†	2,220	-	-	22, 1872,	560	-	60		-
Tunnel Extension, West,*	46,861	14 00	656,054 00	July 1, 1873,	8,967	125,538 00	577		7,675 25
Progress of Heading,†	2,938	-	-	1, 1873,	560	-	87		-

<i>West End Section.</i>									
Heading Enlargement,*	52,800	\$9 75	\$514,800 00	March	1, 1874,	19,772	\$192,679 48	22,145	\$214,193 50
Tunnel Extension,*	82,940	12 00	995,280 00	Nov.	1, 1873,	28,710	344,520 00	22,622	270,359 75
Progress of Heading, East,†	5,200	-	-		1, 1873,	1,800	-	1,652	-
Brick Work,‡	4,500,000	22 00	99,000 00	March	1, 1874,	1,607 <sup>267</sup> / <sub>1000</sub>	35,359 69	1,540 <sup>025</sup> / <sub>1000</sub>	33,882 09
Central Drain, with Pipes,†	6,809	13 00	88,517 00		1, 1874,	2,947	36,320 69	1,111	10,928 85
Excavation only,	1,516	4 35	6,594 00		1, 1874,	486	2,119 50	338	1,470 30
Masonry only,	1,516	3 00	4,548 00		1, 1874,	486	1,461 78	316	948 00
Haupt Tun'l Maintenance,	-	-	8,500 00		1, 1874,	-	-	-	5,033 00
	-	-	\$4,395,794 00	.	.	-	\$1,667,827 66	-	\$1,308,124 10

\* Cubic Yards.

† Lineal Feet.

† Thousand.

*Comparative Statement of Work—Conclud ed.*

ITEMS NOT NOW INCLUDED IN REQUIREMENTS OF REGULAR PROGRESS UNDER THE CONTRACT.

SECTIONS.	Amounts of Original Estimate.		Contract time for Completion.	Total work required to be done to Jan. 1, '71, by terms of contract.		Amount of Work Actually Done up to Jan. 1, 1871.
	Quantities.	Prices.		Quantities.	Amount.	
<i>Amounts brought forward, .</i>	.	.	.	.	\$1,667,827 66	\$1,308,124 10
<i>East End Section.</i>						
Covering old Drain,* .	5,500	\$1 25	March 1, 1874,	-	-	-
<i>Central Section.</i>						
Shaft Sinking Sump,* .	15	395 00	June 1, 1870,	-	-	-
Central Drain with Pipes,*	5,154	13 00	March 1, 1874,	-	-	-
<i>West End Section.</i>						
Covering old Drain,* .	2,500	1 25	March 1, 1874,	-	-	-
Stone Arch,* .	-	-	When ordered,	-	-	-
Western Facade, .	-	-	When ordered,	-	-	-
Railway Track, miles, .	4 $\frac{3}{4}$	14,000 00	March 1, 1874,	-	-	-
Total Amounts, .	-	-	.	-	\$1,667,827 66	\$1,308,124 10
Deduct labor and materials furnished by Commonwealth, .			.	.	.	8,403 80
Amount of Estimates, .			.	.	.	\$1,299,720 30

\* Lineal Feet.



*Railroad from the west end of the Tunnel to North Adams.*

From the west portal of the tunnel about two (2) miles of railroad must be constructed to connect, at the village of North Adams, with the railroad belonging to the State already built, westward to the New York line, and now under lease to the Troy and Boston Railroad Company. The location for this road was made during the latter part of the year 1868, under the direction of the board of tunnel commissioners, being one of the latest of their official acts.


They also secured by purchase about twelve (12) acres of land in the village of North Adams suitable for depot grounds, but no provision has yet been made for obtaining the right of way on the line from thence to the west portal of the tunnel.

In the rapid growth of the village of North Adams it is extending southward along the valley, and upon the district traversed by the railroad line, and land in the vicinity is rapidly increasing in value; one length of county road and some intersecting private streets have been laid out during the past year, and a number of buildings have been erected. In the opinion of the Committee it would be a considerable saving to the Commonwealth to provide for the early acquirement of such land as may be necessary for the purposes of the road.

At the commencement of the railroad line and immediately west of the end of the tunnel is a considerable ridge, the base of which is penetrated by the small tunnel, made by Mr. Haupt previous to 1862.

This ridge is to be excavated with an open cutting at a higher level, for the passage of the railroad. At present this small tunnel (before mentioned) forms the only escape for the water which flows from the west end of the tunnel.

Immediately above, upon the side hill, at an elevation of fifty or sixty (50 or 60) feet, passes the canal which conveys the water of Tunnel Brook (a mountain stream) into the ravine below the ridge. In the freshet of 1869 the artificial embankment to the canal broke, causing the water to pour over the main arch, carrying with it earth and stones which choked the small tunnel, thereby causing the water to flow backward and fill the main tunnel, causing the death of one man and imperilling the lives of many others, besides causing weeks of delay in the workings.



Great pains have been taken, it is true, to secure this channel by careful reconstruction since the break, yet there must always remain the danger of similar disasters until an open cutting is made, and it seems to us that this work ought to be undertaken the coming season.

There are also some portions of the work involving changes of highway which should be provided for very soon, as a saving to the Commonwealth in land damages.

The Act of 1868 provided for the

tunnel, . . . . .	\$5,000,000 00
By supplementary Act, to be ex-	
pended to October, 1868, . . . . .	\$250,000 00
The amount of Shanlys' contract, 4,594,268 00	
	<hr/>
	4,844,268 00
	<hr/>
Leaving balance, . . . . .	\$155,732 00

It would have been entirely consistent with the ultimate purpose of the Act of 1868, above referred to, to wit, the opening of railroad communication between Greenfield and North Adams, to have retained the balance, \$155,732, for the purpose of constructing the tunnel section of the railroad comprising the two (2) miles before referred to, and it is understood to have been especially urged in advance of the framing of the tunnel contract by the members of the then existing tunnel commission, that the contract be made to include the work of the open cutting at the west end.

After a careful examination of this subject, we are of the opinion that it would be a saving to the Commonwealth if authority were given to the governor and council for the early construction of the tunnel section of the Troy and Greenfield Railroad.

In conclusion, the Committee would say that, as to a reasonable doubt of the completion of the tunnel in the time specified in the contract, in view of the difficulties and hindrances and the deficiencies in earnings, which appear in the report that, with this doubt in mind, they have made a close examination into every part of the tunnel work, and have also made themselves perfectly familiar with all the discouraging difficulties

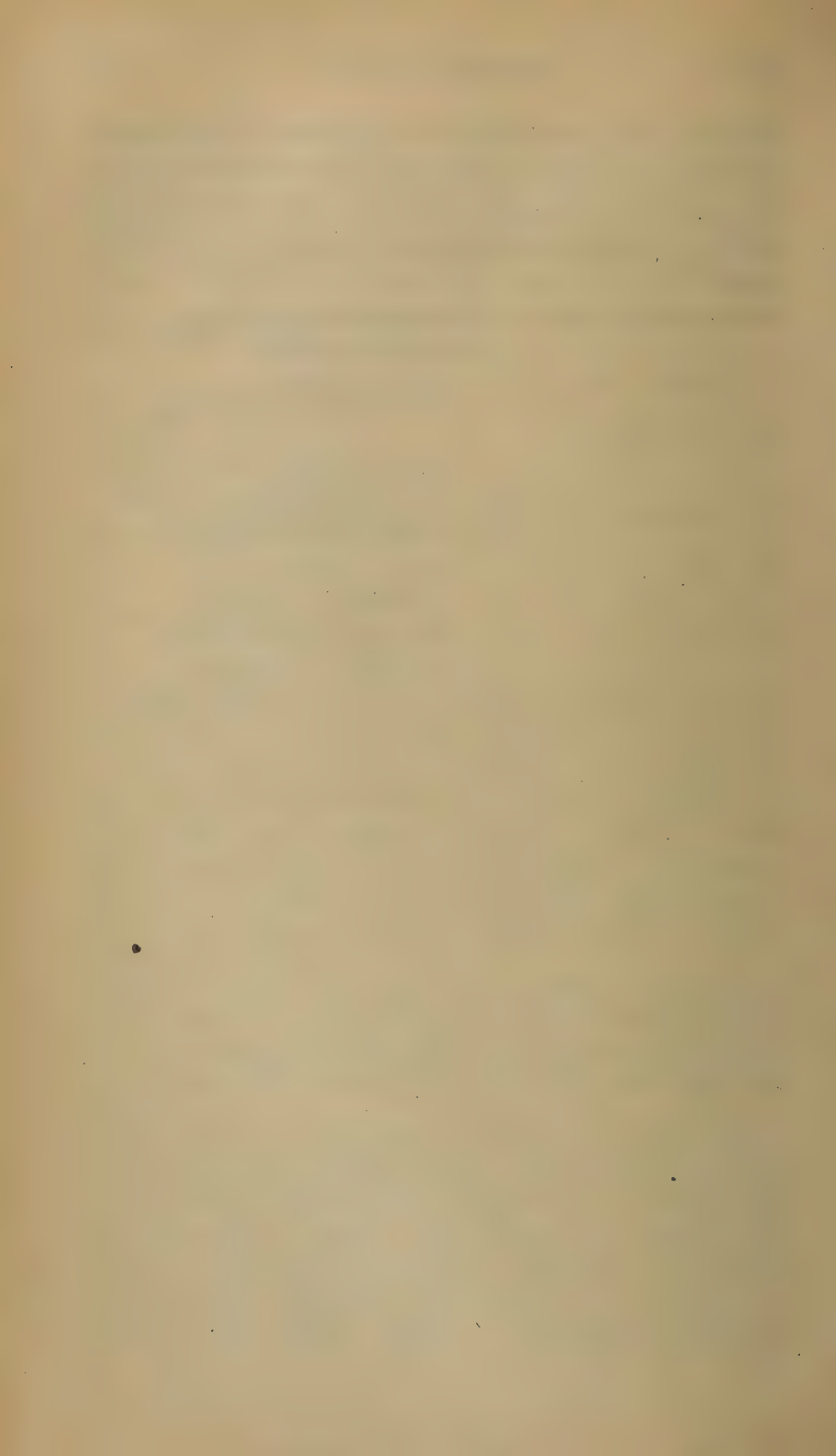
which have from time to time been encountered in the progress of the work in the past, and have carefully compared them with all contingencies that may reasonably be anticipated in the future, and they are settled in the opinion that the contractors will be able to finish the tunnel within the time specified in the contract.

GEORGE M. BUTTRICK,  
JAMES PIERCE,  
A. J. CLARK,

*Of the Senate.*

H. J. BARKER,  
CALEB LOMBARD,  
WILLIAM BARTLETT,  
A. H. CHAMPLIN,  
SAMUEL S. PAINE,  
HENRY A. GOODRICH,  
SAMUEL D. SAWIN,

*Of the House.*





No. 9 C. 1. a

SENATE—No. 250.

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Commonwealth of Massachusetts.

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To the Honorable H. H. COOLIDGE, *President of the Senate.*

SIR :—I have the honor herewith to transmit the Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel, for the year 1871.

With great respect, I have the honor to be,  
Your obedient servant,

JAMES PIERCE, *Chairman.*

MARCH 29th, 1872.

## Commonwealth of Massachusetts.

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The Joint Standing Committee of 1871 on the Troy and Greenfield Railroad and the Hoosac Tunnel, respectfully submit the following Report.

### *Railroad East of the Tunnel.*

That part of the Troy and Greenfield Railroad between Greenfield and the station near east end of the Hoosac Tunnel continues to be occupied under the lease made by the Commonwealth to the Fitchburg and Vermont and Massachusetts Railroad corporations. The immediate control and responsibility of its operation have been taken by the officers of the latter company, who have been guided by a judicious and liberal policy in their administration. In lack of any through route of railroad communication, the freight movement is of course confined to the local accommodation of the valley of the Deerfield and of the region immediately tributary. It is only during the summer months that passenger traffic receives any very large accession from the lines of stage coaches which are run over the mountain and afford transportation between the portions of the completed railroad on either side, thereby connecting a line for through travel from the Atlantic to the Hudson. Notwithstanding these comparatively limited sources of revenue, the managers of the line have kept the railway in excellent repair and have also maintained a most generous provision for the conveyance of passengers and freight, and for the proper development of the business of the route.

The appropriations which were originally made by the legislature for the building of this portion of the railroad, proved barely sufficient for its construction upon the most economical basis of design, leaving no margin for the subsequent improve-

ments which late experience has shown to be both desirable and necessary.

During the year 1870 thorough repairs were made of so much of the line as was actually broken into by the freshet of October, 1869, but these repairs were necessarily limited to those points at which an immediate requirement for expenditure had been developed, and did not attempt elsewhere to improve upon the original construction.

There are now long lines of earth embankment, not sufficiently guarded against the impinging force of the river during extraordinary freshets, which are at such times exposed to danger, and must eventually receive some further reinforcement.

It has been suggested by the engineer that the waste rock to be brought out from the east end of the tunnel, so far as not wanted for the fillings immediately adjacent, should be hauled down over the railroad, and dumped along the slopes for the protection and widening of these embankments. This could be done at only a fractional part of the cost of effecting the same improvement in any other way, and it is evident that the expenditure would be but a small part only of the enhanced value of the railroad, proceeding from the increased permanency and security afforded.

We take the liberty of presenting this suggestion as being deemed by us eminently worthy of consideration.

Between the graded road-bed at the Hoosac Tunnel Station which forms the present western terminus of completed railroad, there extends a distance of about two-thirds of a mile of unfinished line, the greater portion of which is already occupied by an embankment made from the deposit of the material hauled out from the tunnel.

This embankment will be completed within a very few months, and the removal of a short intervening cutting could then afford a continuous and connected grade extending westward from the end of the present track. The extension of this track westward to the tunnel is a matter which must be done upon the completion of the tunnel, in order to make the through connection. It seems very desirable that a portion of this length should be provided for forthwith.

Immediate action in this matter will involve no increased cost to the State, except of the interest accruing by reason of

earlier expenditure. Until wanted for its permanent use as part of the continuous line, it should serve as a standing track for the trains while being loaded with waste rock from the tunnel, designed for rip-rap protection to the railroad embankments.

*Highway across State Lands at the East End of the Tunnel.*

This is successively provided for in chapter 252 of the Acts of 1870, and by chapter 77 of Acts of 1871. From a communication regarding this which has been made to us by Mr. Frost, State Engineer, we take the following statement.

During 1870,  $48\frac{1}{2}$  rods length of road were built, and during 1871  $4\frac{1}{2}$  rods additional.

These lengths join upon existing town roads which suffice for temporary connection and afford an imperfect provision for the travel which this highway when completed will more suitably accommodate. Part of the length remaining to be built must extend over the top of a filling which is yet to be made out of waste material from the tunnel. It was expected that this filling would have been accomplished and the further building of the highway commenced before this date; but circumstances not previously anticipated made it greatly for the convenience of the tunnel contractors to delay this filling until other embankments should be first made. Probably the filling will be made and the work of building the highway accomplished during the ensuing season.

The extension of the same road northward up the valley of the Deerfield River was commenced late in the autumn, under the direction of the Commissioners of Berkshire County, and it is understood to have been brought by December 31 into such a state of forwardness as to admit of the passage of ordinary vehicles, although its entire completion is not expected before the ensuing spring and summer.

*Hoosac Tunnel.*

Since the last session we have visited and examined the workings of the contractors of the Hoosac Tunnel, and find much reason for satisfaction in the apparent energy and ability displayed in pushing forward the work. The rate of progress then prevailing at the East End of the tunnel, as ascertained from the



State Engineer, was more than twenty-five per cent. in excess of contract rate, and the report of the whole year's advance at this point shows an aggregate excess of about sixteen per cent.

The ability to maintain continuously such rapid progress here at certain seasons is dependent upon employment of the steam compressors erected by the contractors. The machinery for compressing air which was provided by the State has been found not adequate for the work now required. The power for driving it is derived from the Deerfield River, and is necessarily dependent upon the uncertain conditions of that stream. Recent changes in modes of working, which involve the employment of machine drills at the work of enlargement, have created a larger demand upon its capacity, and therefore its diminished performance, whether occasioned by ice or by low water, would more frequently become a source of hindrance, but for resort to the auxiliary power of the steam compressors.

The contractors have here made a very considerable expenditure, judiciously applied, because enabling them to accomplish greater amounts of work; but the outlay is so much extra capital invested, for which they receive no payment, and their dividends appear only from the increased amount of the excavations in the tunnel, for which they may receive pay at contract rates.

At the Central Section the work of headings was being advanced in one direction only at the time of our visit. The hindrances at this point had been very serious and considerable, arising from causes that were not expected to appear to any considerable extent at so early a date.

During the early part of the year the contractors made a considerable expenditure in perfecting and completing their equipment and hoisting machinery up to the best condition of repair and efficiency. Subsequently the quantity of water encountered became so great as to exceed the performance of the pumps then in use, and create a necessity for the construction of a new pumping system of largely increased capacity.

Much time and cost were devoted to these successive works of equipment, and the fact of the provision of the large pumps being required at an earlier date than expected, made the delay involved in their erection considerably greater than

if the necessity had been delayed until it was anticipated and provided for.

The conditions mentioned as applicable to the contractors' expenditures for equipment at the east end apply also at this point. The Messrs. Shanly derive no direct compensation from the State for all their provisions of costly machinery for pumping and hoisting, or for their labor of many months in completing and setting them in place, all this having become, in the developed condition of the work, the necessary preparation to enable them to prosecute the excavations in the tunnel for which payments can be made to them under the provisions of their contract.

In the West End Section good performance has been accomplished at the several points of working. In the west heading, for which the outside machinery is established at the west shaft, so much progress has been accomplished during the year as to make up all previous deficiencies, and carry the actual distance reached a little beyond that required by the stipulation of the contract.

We insert here a communication from the State Engineer of the tunnel, which gives details of advance made at the various points of operation during the past year, and a tabulated statement affording comparison of the progress of the successive years of contract work.

ENGINEER'S OFFICE,  
HOOSAC TUNNEL AND TROY AND GREENFIELD RAILROAD, }  
NORTH ADAMS, MASS, February 5, 1872.

*To the Joint Standing Committee for the year 1871 on the Troy and Greenfield Railroad and Hoosac Tunnel:*

In accordance with your request, I have the honor to furnish the following statement concerning the operations and progress upon the works of the tunnel and railroad during the twelve months preceding January 1st, 1872.

The more considerable and important contract with the Messrs. Shanly for completion of the tunnel will naturally claim first attention.

The period above referred to forms the third year of the term since the date of the signatures to their original contract, but the first quarter of 1869 was employed in the accomplishment of the preliminary conditions which that instrument required, and in preparations for the prosecution of the work, and the commencement of

the earliest advancement at the headings was thus delayed till March 29, 1869.

This fact, and also the delays necessarily incident to assembling and applying the successive gangs of workmen employed, should be remembered in order fairly to consider the comparison which is afforded by the tabulated statement given beneath, showing the aggregate distances advanced and values of work done under Shanly's contract in the several years 1869, 1870, and 1871, and also the amounts remaining to be done for completion of the tunnel. The computation of the values is based solely upon the items for which payments are provided to be made to the contractors, and therefore necessarily excludes the cost of machinery and equipment provided by them for the purpose of carrying forward the work.

*Statement of Work done during the years 1869, 1870 and 1871, and of work remaining to be done under F. Shanly & Co.'s Contract for completion of Hoosac Tunnel.*

	Work done in 1869.	Work done in 1870.	Work done in 1871.	Work to be done.	Whole Amount of Contract.
Lineal feet of Headings, . . . . .	1,868	2,864	3,553	7,585	15,690
Value of Tunnel Work, . . . . .	\$405,948 23	\$715,680 96	\$756,981 75	\$2,449,362 06	\$4,327,973 00
Lineal feet of Shaft to grade, . . . . .	215	230	-	2	447
Value of all Shaft Work, . . . . .	92,271 24	94,223 67	3,268 99	10,031 10	199,975 00
Railway Track, . . . . .	-	-	-	66,500 00	66,500 00
Deduct work and material furnished by State, Amount of Work by F. Shanly & Co., .	\$498,219 47 5,830 70 \$492,388 77	\$809,904 63 2,573 10 \$807,331 53	\$760,250 74 - \$760,250 74	\$2,525,893 16	\$4,594,268 00



The lineal feet of headings, as above stated, are in detail as follows:—

	In 1869.	In 1870.	In 1871.
At East End, . . . . .	1,239	1,514	1,743
Central Shaft, . . . . .	—	60	277
{ East, . . . . .			
{ West, . . . . .	—	87	153
West End, . . . . .	449	1,203	1,380
Aggregates, . . . . .	1,688	2,864	3,553

The progress made during the year by headings entering respectively from the east and west ends has been very satisfactory, considerably exceeding the advance of the preceding year, and surpassing the average rates originally prescribed by the contract,

At the East End section, the steam compressors previously erected were brought into operation early in January, and their auxiliary force has been largely employed in supplying air-pressure for the machine drills, at intervals when accumulations of ice in canal, or low stages of water reduced the performance of the turbine compressors below the requirements of the work.

In the West End section, the steam compressors located at the west shaft have proved entirely sufficient to supply the full pressure of air needed for driving the heading, and for the machine drills employed on the bench of enlargement. The building of the brick arch has been pressed forward with a reasonable diligence adequately providing for the early completion of the contemplated continuous length of 2,202 feet extending inward from the west end. Of this distance, 931 were completed by B. N. Farren, under a prior contract with the State, and 1,271 feet belong to the contract of the Messrs. Shanly. Of this, they had finished up to January 1st, 1872, 1,043½ feet, leaving only a length of 227½ feet remaining to be built on this division of the work.

The workings of the Central section, extending east and west from the central shaft, have been greatly delayed, and have much disappointed the expectations of progress in that portion of the tunnel that were entertained in the beginning of the past year.

During the first three months of 1871, a slow advance was made by hand labor in each direction. Within this period there were also accomplished several important matters of equipment and preparation, the more considerable of which were—1st, the operations of setting part of the lower timbering in the shaft and of blasting out a sump or catch-water basin beneath; 2d, perfecting the details and increasing the capacity of the hoisting equipment; and 3d, lowering and putting in position the large carriages for mounting the machine drills designed for employment in progress westward.

These operations necessarily occasioned considerable hindrance and interruption to the advance of the excavations, and their early accomplishment appeared to afford a reasonable expectation of good subsequent progress.

By the last week of March all matters seemed to be nearly in readiness for commencing a more rapid progress in the much desired direction of advance westward; and in view of the favorable nature of the rock just previously encountered, very satisfactory results were anticipated.

It had been intended to make a beginning there with machine drills on the 27th of March, but by that date it was found that a water-bearing vein gradually opened by the progress of a few preceding days had added so largely to the flow in the shaft as to make it exceed the capacity of the pumps. In consequence of this rapid increase, during that day and the next following, the several working gangs were successively withdrawn from the tunnel, and the hoisting engine was applied to the work of bailing from the shaft.

Very shortly afterward preparations were commenced by the contractor for providing an additional set of pumps, of dimensions sufficient to meet the present and immediately prospective requirements of increased capacity; and so soon as the general conditions had been determined, the force of the shaft was set at work preparing and placing the necessary timbering and equipment therefor. It was hoped that not over three months time at most, would be employed to bring this new system of pumps into use, but, by reason of various disappointments and hindrances, they were not got in order for trial until August 7th. On this date they were started, but the working of a single day developed the existence of unexpected defects in an old foundation, upon which the bearings had been placed, and the consequent necessity of a further reinforcement of the construction. So much time was occupied in this additional work, that the new pumps were not again set at work until Oct. 2d,

and after working four days only, the further mishap of a fracture occurring in a large cast-iron bearing-plate, involved a further delay for its replacement, which extended to Oct. 31st. Since the latter date the new pumps have worked regularly and satisfactorily.

As a consequence of the repeated hindrances above related, the amount of work done after March 1st, in this section of the tunnel, falls far short of what had been reasonably anticipated. Progress in an eastward direction only was resumed during the last week in July, and subsequently continued, with some intervals of interruption, during the months of August and part of September, when it had again to be stopped. In November, after the new pumps had been put in operation, it was once more resumed, and early in December, another force having been collected for the west heading, simultaneous progress in both directions was once more established.

The past year's working in this section, although unsatisfactory, by reason of not having contributed its expected share of visible progress toward the final completion of the tunnel, has served to develop indications from which we may form some reasonable estimate of the difficulties to be apprehended, and of the suitable provisions with which they should be encountered.

The fact of the very trifling increase of flow of water, which was developed by the successive workings from May, 1869,—which embraced 445 feet depth of shaft sunk, and distances in tunnel heading of 60 feet east and 87 feet west, making a total horizontal length of 147 feet up to January 1st, 1871,—had doubtless inspired the hope to the contractors of being able to dispense with any considerable provision of pumping equipment, and the subsequent record shows that the unexpectedly rapid accessions of water encountered found them inadequately prepared for the emergency.

The delays of the past year show the urgent importance of forthwith undertaking a provision of additional pumping machinery with capacity sufficient to remove the increased flow of water now anticipated in the further progress of the excavation. Prompt action is necessary to secure continuous westward workings from the shaft, by aid of which we may hope and expect to finish the tunnel within limits of time contemplated by the contract.

The date at which the completion of the tunnel may fairly be expected is the matter of greatest interest to the public in connection with this work, and the details, heretofore stated, will interest the large majority only so far as they may confirm or con-



tradict previous anticipations, or afford new elements for determining this question.

Experience thus far gives no sufficient authority for departing in computations of the expected average result from the rates of progress specified in the contract. Although these have been heretofore largely exceeded at some points, yet the exceptional hindrances recurring at others have made the aggregate, up to this date, considerably short of the requirements of that instrument. The differences between its required conditions and the actual accomplishment by the contractors will appear by the inspection of the comparative statement up to January 1st, 1872, which I forward herewith.

The difficulties and probable requirements are now so far developed as to indicate, more surely than heretofore, the necessity of very considerable addition to the equipment to meet expected requirements. If these be supplied with due expedition the average of contract rates may probably be attained as to the whole distance remaining to be opened. Although greater rates have been and may be accomplished wherever uninterrupted working can be secured, this excess cannot with certainty be counted upon as more than sufficient to compensate for apprehended delays and interruptions.

Taking the distances remaining to be opened as established by my measurements, and assuming the average future progress to be made at original contract rates, the following statements are obtained :—

Distance remaining to be opened after January 1st, 1872 :

Between East End and Central Shaft, . . . .	2,721 feet,
Probable time of meeting the headings, . . . .	Feb'y, 1873.

Distance remaining to be opened after January 1st, 1872 :

Between Central Shaft and West End, . . . .	4,864 feet,
Probable time of meeting the headings, . . . .	April, 1874.

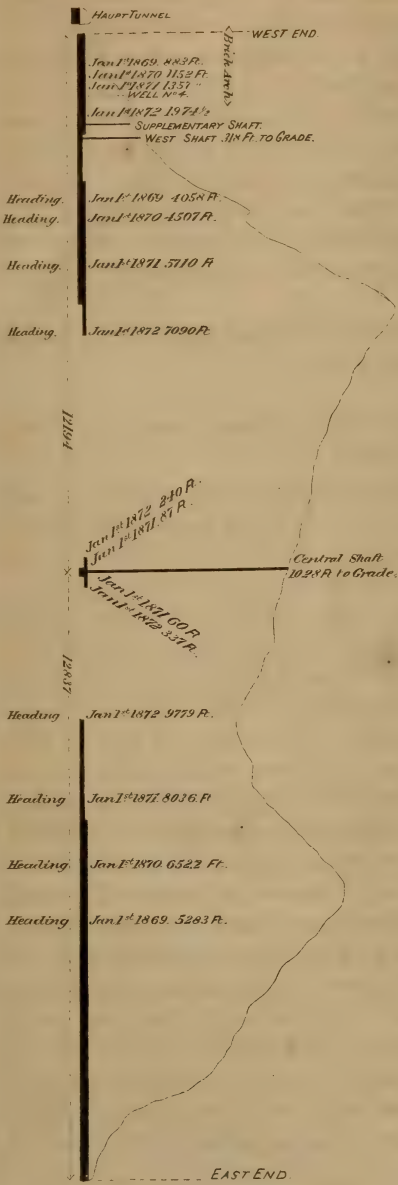
After the last meeting of the headings shall be accomplished, even if all proper diligence shall be observed in completing and trimming up the excavations and in following the headings as closely with the breasts of enlargement as reasonable convenience in working may permit, there will yet occur an interval of some few months employed in the several matters of carrying forward the





# PROFILE OF HOOSAC MOUNTAIN.

Showing Progress of the Tunnel  
up to Jan. 1<sup>st</sup> 1872.



latest breasts to the meeting point, and completing their excavation out to full tunnel dimensions,—in building and covering central drain,—and in laying the railway track,—before the tunnel can be made available for traffic. It is not possible to define in advance the exact conditions which may affect the length of this interval; but the requirements of the contract are so framed as to prevent its undue extension by unwisely delaying, to a late moment, the work of trimming and completing excavations over lengths of enlargements already opened. This has already been commenced, and is expected to be prosecuted with such reasonable energy that it may not unnecessarily defer the date of final completion and occupation of the tunnel.

I herewith enclose a diagram of the tunnel, showing the whole progress made up to January 1st, 1872.

*Railroad between the West End of the Hoosac Tunnel and North Adams.*

Under the instructions of the executive council, made in accordance with the provision of the Act of the last legislature, early in the summer I revised and finally established the location of the line between the western portal of the tunnel and North Adams.

Messrs. Rodman H. Wells and Edwin Thayer, of North Adams, were appointed subsequently agents of the governor and council for adjustment of land damages; and these gentlemen, under guidance of a committee of the council, succeeded, during the year, in making amicable adjustment, by bargain or reference, for the purchase of all the lands needed for the railroad between the tunnel and the depot grounds at North Adams. The aggregate cost, including expenses of commissioners and referees, &c., amounted to \$35,393.

Early in November proposals were invited by the council for the graduation and masonry; and out of the tenders received, those of Messrs. McClallan, Son & Walker were found to be the lowest, and a contract was entered into with those parties accordingly. At their prices per cubic yard, for the several descriptions of excavation and masonry required, the engineer's estimates of quantities would make their contract reach a gross sum of \$149,300; but this amount will be somewhat varied in the actual result, according to the relative proportions of earth and rock which shall be developed in the excavations, as to which, estimates made in advance can only afford an approximate indication.

Although not strictly embraced within the scope of your inquiries, which apply only to the transactions of the year 1871; yet it is ap-

propriate to mention that these gentlemen commenced work under their contract early in the month of January of the present year, and in spite of the inclement weather prevailing, have already made some considerable advance.

Very respectfully, your obedient servant,

BENJ. D. FROST.

It appears by this communication that the progress attained during the past year in the headings, both at the East and West ends of the tunnel, has considerably exceeded that of the preceding year, and is now, in each of these instances, in advance of the point required by the stipulation of the contract.

The serious hindrances encountered at the Central Shaft have proceeded mainly from the necessity of providing for removal of the largely-increased amount of water developed by the workings of this year.

The probability of encountering any considerable flow in such close proximity to the shaft seems not to have been suggested by previous indications ; and we think it not surprising that the contractors, while desirous to bring their equipment of hoisting and working machinery up to the best condition of performance, should have devoted all their energies to the completion of these constructions, and delayed provision for a contingency regarded by them as probably remote enough to afford ample time for preparation.

When the immediate necessity of increasing pumping facilities was demonstrated, they seem to have shown a reasonable promptness and energy in maturing their plans and proceeding to carry out the measures for providing the requisite equipment and machinery. The subsequent circumstances by which their operations have been delayed or interrupted appear as among the casualties of which the occasional occurrence is to be anticipated during the progress of any considerable enterprise.

In order to present the relation which the quantities of work actually performed by the contractors bear to whole amount which they would have accomplished by maintaining, without interruption, to this date, the rates of progress stipulated in their agreement, the Committee have obtained from the State Engineer of the tunnel a comparative statement of work required by



contract, and of work actually done,—from which it appears that this value of all the items undertaken or completed, to which the requirements of progress are yet applicable, should have been, up to January 1st, 1872, \$2,852,969.27, and the value of items actually done, up to that date, was \$2,059,971.04. The difference or deficiency being \$792,998.23, of which \$634,757.60, or more than three-quarters, proceeds from the operation at the central section, as to which we have just before mentioned the circumstances that have occasioned interruptions and delays.

## COMPARATIVE STATEMENT

*Of Work required by the Contract, and Work actually done at the Hoosac Tunnel, up to January 1, 1872.*

[Furnished to the Joint Standing Committee of 1871 by BENJAMIN D. FROST, State Engineer at the Tunnel.]

## ITEMS THAT MAY BE NOW INCLUDED IN REQUIREMENTS OF PROGRESS UNDER THE CONTRACT.

SECTIONS.	Amounts of Original Estimate.			Contract time for Completion.	Total work required to be done to Jan. 1, '71, by terms of contract.		Amount of Work Actually Done up to Jan. 1, 1872.	
	Quantities.	Prices.	Amount.		Quantities.	Amount.	Quantities.	Amount.
<i>East End Section.</i>								
Tunnel Enlargement,*	4,500	\$16 00	\$72,000 00	May 1, 1872,	4,097	\$65,566 12	3,875	\$58,506 25
Heading Enlargement,*	28,000	9 00	252,000 00	Aug. 1, 1872,	22,917	206,258 60	28,264	247,144 75
Tunnel Extension,*	85,100	11 00	936,100 00	Feb. 1, 1873,	60,290	663,058 58	54,871	595,984 75
Progress of Heading,†	5,335	-	-	Nov. 1, 1872,	4,152	-	4,496	-
Central Drain with Pipes,†	5,600	13 00	72,800 00	Feb. 10, 1873,	3,716	48,308 00	3,973	27,537 45
<i>Central Section.</i>								
Shaft repairing Timber,†	583	10 00	5,830 00	When ordered, .	583	5,830 00	583	5,247 00
Trimming,*	100	33 00	3,300 00	"	100	3,300 00	90, <sup>7a</sup> <sub>10b</sub>	2,995 74
Sinking,†	447	395 00	176,565 00	May 1, 1870,	447	176,565 00	445	174,811 17
Sinking Sump,†	15	395 00	5,920 00	June 1, 1870,	15	5,920 00	-	2,782 99
Pipes,†	1,030	6 00	6,180 00	June 1, 1870,	1,030	6,180 00	759	2,277 00
Fire-Proof Floor and Hatches,	-	-	2,000 00	When ordered, .	-	2,000 00	-	1,650 00
Tunnel Extension, East,*	35,409	14 00	495,726 00	Sept. 23, 1872,	24,339	340,746 00	2,436	32,902 50
Progress of Heading,†	2,220	-	-	Sept. 23, 1872,	1,520	-	337	-
Tunnel Extension, West,*	46,861	14 00	656,054 00	July 1, 1873,	24,339	340,746 00	1,754	23,863 00
Progress of Heading,†	2,938	-	-	July 1, 1873,	1,520	-	240	-



*Comparative Statement of Work—Concluded.*  
 ADDITION OF ITEMS NOT NOW INCLUDED IN REQUIREMENTS OF REGULAR PROGRESS UNDER THE CONTRACT.

SECTIONS.	Amounts of Original Estimate.		Contract time for Completion.	Total work required to be done to Jan. 1, '72, by terms of contract.		Amount of Work Actually Done up to Jan. 1, 1872.
	Quantities.	Prices.		Quantities.	Amount.	
<i>Amounts brought forward, .</i>	.	.	.	.	\$2,852,969 27	\$2,069,917 84
<i>East End Section.</i>						
Covering old Drain, *	5,500	\$1 25	March 1, 1874,	—	—	—
<i>Central Section.</i>						
Central Drain, with Pipes, *	5,154	13 00	March 1, 1874,	—	—	—
<i>West End Section.</i>						
Covering old Drain, *	2,500	1 25	March 1, 1874,	—	—	—
Stone Arch, .	—	—	When ordered, .	—	—	—
Western Facade, .	—	—	" "	—	—	—
Railway Track, miles, .	4 $\frac{3}{4}$	14,000 00	March 1, 1874,	—	—	—
	—	—		—	\$2,852,969 27	\$2,069,917 84
Deduct for embankment above grade at East End, .			.	.	.	\$1,543 00
Deduct labor and material furnished by Commonwealth, .			.	.	.	8,403 80
Amount of Estimates, .	.	.	.	.	.	9,946 80
						\$2,059,971 04

\* Lineal feet.



*Railroad from West End of the Tunnel to North Adams.*

The action taken during the past year concerning the portion of railroad to be built from the western portal of the Hoosac Tunnel to the depot at North Adams, is stated somewhat in detail in the communication of the State Engineer heretofore given. It embraces the establishment of the line of final location, the purchase of the necessary lands and the completion of a contract with Messrs. McClallan, Son & Walker, for the graduation and masonry, to be completed by the first day of November, 1873.

The result of our inquiries has convinced us that the purchase of the necessary lands, embracing many village lots, has been effected with much discretion, and in a manner reflecting great credit upon Messrs. Wells and Thayer, the agents employed by the governor and council for this purpose. The first named of these gentlemen, Mr. Rodman H. Wells, was brought in immediate communication with several of our number in connection with our visit and examination of the route, and in view of his recent decease, which has occurred since our commencing the preparation of our Report, it becomes especially appropriate that we should record the conviction impressed upon us of the conscientious disposition with which he had assumed the performance of this duty, in which, as in many previous responsible positions which he had occupied, he had gained the unreserved esteem and confidence of those associated with him.

In regard to the contract effected with McClallan, Son & Walker, it is sufficient for us to state, that the firm of C. McClallan and Son of Chicopee, is well-known in the region adjacent to this, for excellent and faithful performance of all the various constructions which they have heretofore undertaken, and that Mr. T. M. Walker of Springfield, has an excellent business reputation, which makes his association in the firm an additional guarantee of the due accomplishment of this undertaking.

*Railroad west of North Adams.*

The western portion of the Troy and Greenfield Railroad, extending in a north-western direction from North Adams to the State line of Vermont, and the Southern Vermont Railroad extending thence north-westerly through the south-western corner of Vermont, both transferred to the State by the Troy and

Greenfield Railroad Company, under previous mortgages and by the final conveyance made in 1862, are now operated under a previous lease by the Troy and Boston Railroad Company, in connection with their own road which forms the extension of the route westward to the city of Troy.

During the last year the long-standing claim of that company for their work in completing the unfinished construction of the portion of the railroad leased by them has been adjusted; and by the same settlement very valuable lands adjacent to the North Adams depot, which had been bought by the company because found essential even for their temporary occupation under the lease, have been conveyed to the State.

These lands adjoin those which have been purchased by the State agents, and together form an extensive and convenient area of depot grounds, suitable for the extended accommodation of the traffic which is shortly to be anticipated.

#### *General Remarks.*

The near approach of the date of completion of the tunnel, at which time the present leases of the several finished portions of the Troy and Greenfield Railroad will expire, and the whole line, as originally chartered, will come into the direct control of the Commonwealth, leads to a more immediate appreciation of all circumstances which affect the value of the property.

Already suggestions have been made and proposals offered which, although inadequate and insufficient, show that it is deemed capable of yielding a remunerative income upon a very considerable investment.

Being ourselves impressed with a belief in the great importance of the route to the prosperity and development of many great interests, we find pleasure in perceiving that this is becoming more generally recognized under an intelligent discussion as the means of employing its capacity for the most beneficial results.

JAMES PIERCE,  
A. J. CLARK,  
S. THAYER,  
*Of the Senate.*

CALEB LOMBARD,  
H. A. GOODRICH,  
ROBERT JOHNSON,  
J. P. FOLSOM,  
WEAVER OSBORN,  
FRANCIS P. ARNOLD,  
JAMES T. BURNAP,  
*Of the House.*

C. a.  
No. 10

SENATE . . . . No. 201.

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Commonwealth of Massachusetts.

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*To the Hon. George B. Loring, President of the Senate.*

SIR:—I have the honor herewith to transmit the Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel, for the year 1872.

Your obedient servant,

ROBERT JOHNSON, *Chairman.*

BOSTON, April 30, 1873.

## Commonwealth of Massachusetts.

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The Joint Standing Committee of 1872, on the Troy and Greenfield Railroad and the Hoosac Tunnel, respectfully submits the following Report, concerning the matters of railroad and tunnel property of the Commonwealth, and the progress towards completion accomplished during the year.

### *Railroad East of the Tunnel.*

That part of the railroad between the eastern terminus at Greenfield and the Hoosac Tunnel station has been maintained and operated in the same manner as during the last preceding year, under the lease which the Fitchburg and Vermont and Massachusetts Railroads jointly hold from the Commonwealth. Its actual management has been conducted as heretofore by the Vermont and Massachusetts Railroad, which has pursued throughout an efficient and liberal policy tending to develop the local business of the adjacent region. The line of stages established by this company continues to afford daily transportation over the Hoosac Mountain, and to make connections at North Adams with the trains of the Troy and Boston Railroad, thus accommodating the movement of the yet limited passenger traffic that seeks this line of conveyance from Boston to the Hudson River, or between the intermediate regions which lie respectively to the east and west of the Hoosac Mountain, and of which it seems to form the distinct line of geographical separation. From the present end of the railroad track (which is the limit of the portion held under the lease just before mentioned) there extends a length of about two-thirds of a mile of unfinished grading. On the several portions of this, some work of graduation has been done in different years preceding, but



no part is so far completed as to be ready to receive the permanent railway track.

Under one of the requirements of the contract made with the Messrs. Shanly for building the Hoosac Tunnel, a large quantity of debris brought out from the excavation of that work has been hauled across the railroad bridge to the east side of the Deerfield River, so as to make an embankment of which the eastern end reaches to a distance of three thousand feet from the portal of the Tunnel. A length intervenes of but a few hundred feet between the end of the track at the Hoosac Tunnel station and the eastern end of the embankment above mentioned. The removal of the excavation to complete the grading of the road-bed for this distance was provided for in chapter 287 of the Acts of 1872, which includes the appropriation of an amount applicable to the purpose. Pursuant to this provision proposals for the execution of the work were invited by the governor and council, and a contract was executed with the lowest bidder. Under this contract work was commenced early in November and continued till the arrival of severe winter weather made it advisable to withdraw the force and await the return of a more favorable season for its completion.

Between the railroad bridge over the Deerfield River previously mentioned and the eastern portal of the Hoosac Tunnel, the graded way, which the contractors have used for conveying the material of excavation brought out from the Tunnel, does not follow throughout the line of permanent route for the railroad. There remains a considerable amount of work yet to be accomplished in the completion and widening of the cuttings and in the establishment of the embankments for the final road-bed. In connection with this work appears, also, the necessity of making some permanent constructions for guiding and transmitting the flow of "Cascade" Brook. This brook derives its sources mainly from the drainage of the slopes adjacent to the stage-road in its route up the face of the eastern spur of the Hoosac Mountain. Passing near the portal of the Tunnel in its further course toward its present outflow into the Hoosac River, it occupies for a certain distance part of the ground which must finally support the embankment for the railroad. The stream has, occa-

sionally, when swollen by unusual freshets, broken out of its ordinary limits and thrown a large volume of water into the partially excavated road-bed for the railroad adjacent to the Tunnel. This has happened in repeated instances since the early commencement of the Tunnel enterprise, and the discharge has sometimes been of such considerable quantity as to enter the Tunnel and interrupt the labors of the workmen till a partial subsidence of the excessive flow again left the usual water-way sufficient for its disposal.

After the occurrence of the extraordinary freshet of October, 1869, which for a time caused the suspension of all operations in the eastern workings of the Tunnel, the contractors built the barriers now confining the stream, which give for the present a reasonable security against recurrence of the same hindrances. These barriers, however, while probably sufficient for their purpose if suffered to remain undisturbed for the duration of the Tunnel contract, must of necessity be removed at an earlier date to give way to the grading of the road-bed for the railroad in its approach to the Tunnel, and this will create occasion for providing a suitable and permanent channel properly adapted to the new conditions involved in the completion and operation of the railroad.

It is not possible for us to enter into a full and complete detail of the various constructions required for the completion of the railroad line, but it has seemed important to make mention of some of the more obvious deficiencies on the unfinished length adjacent to the Tunnel, and to direct the attention of the legislature to the necessity for further appropriations at the present session, in order that the work of building may be carried forward in season to make the railroad continuous, and in a certain degree available for use upon the completion of the Tunnel. The supply of a railway track over the distance between the Hoosac Tunnel station and the east portal of the Tunnel, and the building of sufficient length of side tracks to be placed on the adjacent grounds, are among the necessary provisions to be made in order to accomplish this purpose.

*Highway across State Land at East End of Tunnel.*

This is a matter involving a comparatively small pecuniary amount, but of importance to the interests of the State involved in the railroad, and also to the accommodation of the dependent region which comprises the upper part of the valley of the Deerfield River. Chapter 252, section 3 of Acts of 1870 authorizes the building of this highway, and made appropriation of the amount of \$1,500 to be employed for that purpose. Part of the distance was built in 1870 and 1871. In the report of the chief engineer of the Tunnel, (which is appended hereto) is given a statement of the reasons for delaying its progress. The execution of adjacent and accessory works now affords the suitable opportunity for again resuming this construction, but the unexpended balance of the appropriation for this purpose has meanwhile lapsed, under the rules of the financial department, by reason of not having been taken from the state treasury within two years from the passage of the Act. It should now be made available by additional legislation in order that this work may be again resumed and carried forward to completion.

*Hoosac Tunnel.*

The progress of this work during the past year seems to evince very commendable diligence and faithfulness on the part of Messrs. Walter and Francis Shanly, contractors.

The advance of heading westward from the central shaft was suspended during more than ten months of the year by reason of enforced delays arising out of the large volume of water encountered, and the apprehension of developing a further increase of quantity which should exceed the resources of the pumping machinery provided for its removal.

Notwithstanding the suspension of progress at this single point of advance during the greater part of the year, the great exertions made at the other points of penetration, seconded by very remarkable immunity from any considerable delay, have given an aggregate quantity of work in lineal feet of heading opened during the year which considerably exceeds the amount of advance for that time that would have been reasonably anticipated if the difficulties and dangers



of interruption which were to be met with had been fully apprehended.

As the result of their efforts and of the favorable conditions more fully set forth in the statements of the engineer, it appears that the contractors have during the year accomplished a material improvement upon their previous deficiency of progress as compared with the specific requirements of their contract and considerably increased the measure of probability of their completing the Tunnel within the limit of time which it prescribes.

That instrument, it will be remembered, establishes March 1, 1874, as the date for completion, with a provision for such extension of time, not exceeding six months at most, as the future difficulties or emergencies of the work might seem to require.

For a more particular account of the various facts and details pertaining to the progress of the work on the Tunnel during the past year, we would refer to the supplementary report or statement which has been furnished us by the state engineer, and which we transmit as an appendix in this document. With the aid of this, we have been able to place in more definite and satisfactory form, results and conclusions for which our own observations alone could have furnished but partial and incomplete guidance.

Before departing from the subject of Tunnel operations, it seems appropriate for us to mention our gratification in the remarkable exactness obtained by the engineers in the extension of their alignment. This was determined by the meeting effected near the close of the year (December 12, 1872) between the hitherto separate galleries respectively extending from the eastern portal westward into the mountain, and from the bottom of the central shaft eastward. In proportion to the difficulties of the problem of correctly extending these separate underground passages toward each other, with only the guidance of direction afforded at the respective terminal points, one of which had to be established for the starting at a depth of more than one thousand feet below the surface of the earth, should be the measure of praise awarded for its skilful and successful execution. That a scarcely discernible departure from the exact direction



should have been suffered in proceeding for so long a distance is an achievement of remarkable accuracy that seems fully to justify the confident expectation of correct results, which has been expressed by the chief engineer during all the term of preceding anticipation.

*Railroad between the West End of the Tunnel and North Adams.*

In January, 1872, Messrs. McClallan, Son & Walker commenced work under their contract for the graduation and masonry of this portion of the railroad, about two miles in length, and during the year past they have prosecuted the work with such reasonable diligence as to have already built a considerable length of nearly completed road-bed, and have finished, or nearly finished, several of the structures of masonry. We are informed by the engineer that they have evinced throughout an excellent disposition faithfully to execute all the essential conditions of their contract.

The appropriation heretofore made in 1871 for this portion of the railroad, only provides for land-damage, masonry and the grading of a road-bed of single-track width. The matters of grading portions of the line for second-track width, and of providing bridge-superstructure and railway tracks and other necessary additional details of construction, must be anticipated by a further appropriation.

*Railroad between North Adams and the State Line of Vermont.*

This division of the railroad, six and two-thirds miles in length, forming the last link of the line of the Troy and Greenfield road, was completed under the auspices of the Troy and Greenfield Railroad Company, before the surrender of their property and franchise to the Commonwealth, and was leased by that corporation to the Troy and Boston Railroad Company for the intermediate term then preceding the completion of the tunnel. Under the prudent and wise management of this latter company, the road-way, originally of very imperfect construction, has been economically strengthened and improved to such extent as seemed requisite for their traffic, and its officers have also, within the limits of the pre-

sumed ability of the corporation, taken pains to develop and foster the local business of the line upon which they have been mainly dependent for such returns of income as have hitherto accrued. The anticipated completion of the Hoosac Tunnel will bring this part of the Troy and Greenfield Railroad, alike with the other portions, under the unlimited control of the Commonwealth, and subject to such disposition as the legislature may enact.

#### *Southern Vermont Railroad.*

This line of six miles of railroad, following in its route the valley of the Hoosick River, extends in a north-westerly direction across the south-western corner of Vermont, to a junction with the Troy and Boston Railroad at the eastern line of the State of New York. The title vests in the Commonwealth, but the immediate interest of the State is now confined to the receipt of an annual rental for its use from the Troy and Boston Railroad Company, which holds it under the perpetual lease that was obtained from the Southern Vermont Railroad Company before the sale by that corporation of the ownership of its railroad to the Troy and Greenfield Railroad Company, through whom the State has subsequently obtained its title.

We have mentioned this because of its being one of the adjacent railroad interests of the Commonwealth to which we deem it appropriate for us to make reference, but in all considerations as to railway connection and management, it may practically be deemed a portion of the Troy and Boston Railroad, inasmuch as this company holds the unlimited power of its management and control.

In our further remarks, therefore, concerning the railroad property of the Commonwealth, we desire to exclude any reference to the Southern Vermont Railroad, and to be understood as intending to consider only the matter of the Troy and Greenfield Railroad.

#### *General Considerations.*

Upon the completion of the Tunnel—an event probably but little more than one year distant—the Commonwealth will become the owner, without restriction, of a line of railroad

nearly forty-four miles in length, which occupies a position rendering its suitable improvement a matter of very material consequence to the interests of a large portion of the State.

Whatever view may be taken as to the best method of providing for its ultimate control and management, it is first of all essential that no time be lost in bringing this important highway into the condition of approximate completion which is necessary for the suitable accommodation of such business as will, at the outset, seek to avail of its new opportunities.

The result for which the public has for years been waiting, and for the accomplishment of which the Commonwealth has assumed a considerable burden, is now nearly at hand. The earlier and more complete the facilities afforded, the more rapid will be the development of traffic and the advance of the Commonwealth in the material prosperity dependent upon its increasing volume.

Neither desirous nor willing to present any considerations which should seem to affect the decision of the important questions now under consideration, we feel it incumbent upon us to urge only this matter;—that either to the Executive and Council, which have for many years constituted the trusted and efficient Directory of this work, or to some other agents selected by the legislature, be entrusted such abundant means and authority as may enable them to carry forward the works of accessory construction and preparation needed to make the line available for the purposes in view of which its building has been undertaken and prosecuted.

ROBERT JOHNSON,  
RUFUS D. WOODS,  
GEORGE SHELDON,

*Of the Senate.*

WILLIAM J. WIGHTMAN,  
GEORGE H. HOYT,  
OLIVER AYERS,  
GEORGE H. POOR,  
C. C. MERRITT,  
BROWNELL GRANGER,  
ELBRIDGE C. DONNELL,

*Of the House.*



ENGINEER'S OFFICE,  
HOOSAC TUNNEL AND TROY AND GREENFIELD R. R., }  
NORTH ADAMS, MASS., April 15, 1873.

*To the Joint Standing Committee for the year 1872 on the Troy and Greenfield Railroad and the Hoosac Tunnel.*

In compliance with your request, I have the honor to furnish to you the following Report as to the operations of the past year in the works of construction of the Tunnel and adjacent portions of the railroad, with statements of progress accomplished up to January 1st, 1873.

The unfinished portion of the railroad which lies between the western end of the track, near the Hoosac Tunnel station and the east portal of the Tunnel, embraces (as you will remember) the bridge over the Deerfield River. The construction of this bridge was commenced by direction of the State commissioners, in 1868, and completed under authority of the Governor and Council during the ensuing year.

The work of grading for this section includes the excavation required for making the road-bed through a projecting point of the adjacent mountain but a short distance west of the railroad station. For the performance of this excavation, which was provided for in chapter 287, Acts of 1872, proposals were invited by the governor and council September 13, 1872, and by their direction a contract was subsequently executed with the lowest bidder. The work under this contract was commenced in November and prosecuted with reasonable diligence during that month and the greater part of December, but in the intensely cold weather which at last prevailed, the position of the excavation, which exposed it to the full force of the winds that swept through the river valley, made the labor there uncomfortable to the workmen and its result unprofitable to the contractor. In view of this he decided to withdraw his force, making the promise to resume the work in more favorable weather, so as to accomplish its completion whenever required.

For the distance not included in the above contract and extending westward to the bridge, the road-bed to subgrade is already substantially built on a deep embankment, the material for which has been supplied from rock excavated in



# PROFILE

OF

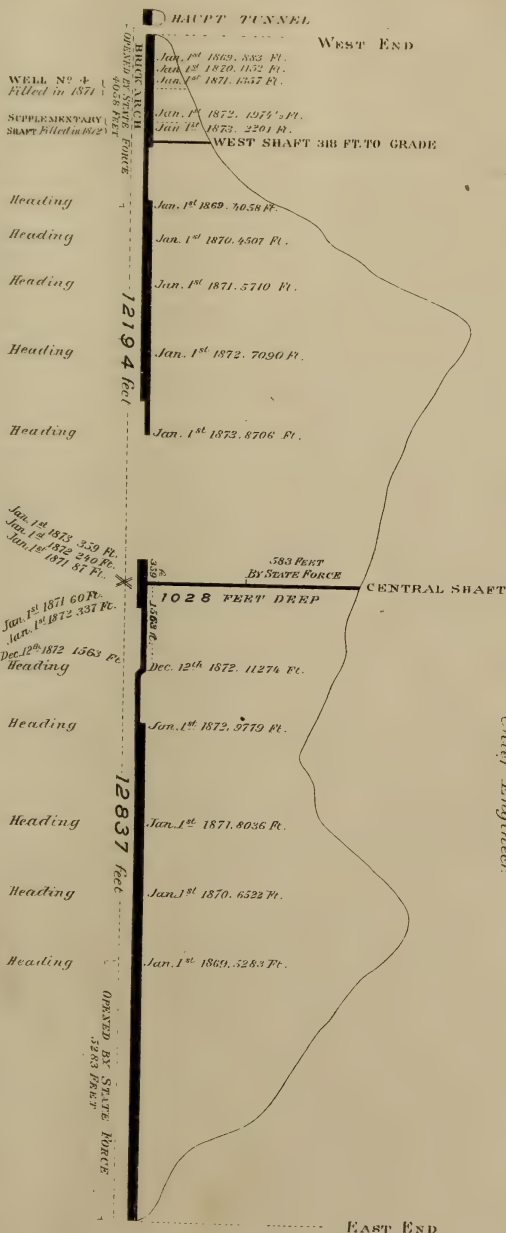
## HOOSAC MOUNTAIN

Showing Progress of the Tunnel

UP TO JAN. 1<sup>ST</sup> 1873.

BENT. D. FROST

Chief Engineer.





the Tunnel, and hauled out and deposited according to one of the stipulations of the Tunnel contract, thereby involving no cost beyond the payment allowed for Tunnel excavation.

The embankment,—made for nearly the whole distance to a width sufficient for the laying of four railroad tracks,—was completed in the month of April. Upon the length which extends from the Deerfield River to the east portal of the Tunnel, no work has been done and the graduation remains in the same incomplete condition as when the State force was withdrawn in the latter part of 1868.

*Highway across the State lands at East End of the Tunnel.*

So much of this road as could then properly be built, was completed in 1870 and 1871. Over the distance not worked at that time, a town road, built many years since, and somewhat improved for the convenience of transportation connected with Tunnel operations, has thus far given a passable way and afforded sufficient accommodation. It became necessary to make this temporary resort for the reason that the conditions of best location and most economic construction upon the route approved by the commissioners of Berkshire County, in 1870, involved dependence upon the material to be hauled from the Tunnel to supply the very large amount of filling requisite to support the roadway at suitable grade.

The work of making this deposit has been delayed considerably beyond the time then contemplated, being properly deferred to the prior completion of the length of the railroad embankment.

It was originally designed to extend the first filling for the railroad with a width of two tracks only, leaving the work of widening to be done after deposit of the filling for the highway had been made, but considerations of advantage in the working have led to the course adopted, as to which no complaint has been made on the part of those interested in the early completion of the highway.

*Hoosac Tunnel.*

The operations during the year by Messrs. Walter and Francis Shanly, contractors, upon their contract for the completion of this work, were prosecuted with most excellent

resource and energy. They have been attended in some respects with an exceptional measure of good fortune and exemption from hindrances, and have attained results of progress eminently satisfactory, in view alike of the sources of delay which were apprehended, and of the actual difficulties met and surmounted. The lineal feet of headings and of shaft excavated, and value of work done by them in each of the successive years since their commencement of work, and also the amount and value of work yet required to be done for completion of their contract, are shown in the following statement :—



*Statement of Work done during the year 1869, 1870, 1871, and 1872, and of work remaining to be done under F. Shanly & Co.'s Contract for completion of Hoosac Tunnel.*

	Work done in 1869.	Work done in 1870.	Work done in 1871.	Work done in 1872.	Work to be done.	Whole Amount of Contract.
Lineal feet of Headings, . . .	1,688	2,864	3,553	4,456	3,129	15,690
Value of Tunnel Work, . . .	\$405,948 23	\$715,680 96	\$756,981 75	\$826,059 87	\$1,623,302 19	\$4,327,973 00
Lineal feet of Shaft to grade, . . .	215	230	-	-	2	447
Value of all Shaft Work, . . .	92,271 24	94,223 67	3,268 99	-	10,031 10	199,795 00
Railway Track, . . .	-	-	-	-	66,500 00	66,500 00
Deduct work and material furnished by State, . . .	\$498,219 47	\$809,904 63	\$760,250 74	\$826,059 87	\$1,699,833 29	\$4,594,268 00
Amount of Work by F. Shanly & Co.,	\$492,388 77	\$807,331 53	\$760,250 74	\$826,059 87		

The separate lengths of heading penetration at the different points of advance which make up the aggregate of lineal feet for each year in the foregoing statement, are given in tabulated form as follows :—

ADVANCE OF HEADINGS.	In 1869.	In 1870.	In 1871.	In 1872.
From East End, . . . .	1,239	1,514	1,743	1,495
Central Shaft, { East, .	—	60	277	1,226
{ West, .	—	87	153	119
West End, . . . .	449	1,203	1,380	1,616
Aggregate lineal feet, . .	1,688	2,864	3,553	4,456

The proportion and relative position of the several amounts of progress accomplished in the successive years as recorded in the foregoing statements, and also the distances attained by the state force previous to the execution of the present contract, appear more plainly shown on the sectional diagram of the Hoosac Mountain which I have prepared and will append to this communication. It will also serve as a convenient reference for obtaining a more complete apprehension of various other details of Tunnel work herein described.

The stipulations of the contract establish certain specified rates of progress as the average accomplishment to be required of the contractors in order to insure the completion of their undertaking within the limit of time prescribed. These several rates had been determined upon the bases of the previous experience of the State with the working of machine-drills, then of but little more than two years' duration, with a necessarily conjectural anticipation of the difficulties and hindrances yet to be encountered.

It was reasonably to be expected that the actual conditions experienced in the successive years of the prosecution of the work might materially vary from the projected schedule. The considerable improvements in the Burleigh machine-drill, which were at the date of the schedule just approaching ma-

turity, have since been brought into use and have been found, as expected, to largely increase its efficiency as well as economy of working.

The employment of nitro-glycerine as an explosive agent had been only a very short time practically established and it was understood that the most economical and efficient methods and experience for its use had not yet been attained.

In like manner also a better training and direction of the labor of the workmen and the better adaptation of all mechanical means and appliances was to be expected to follow with each succeeding year.

These sources of probable improvement, which in the view of many friends of the enterprise gave grounds for hoping its completion at a date even earlier than was named by the contract had been previous and up to the beginning of the year 1872, so far balanced by countervailing sources of hindrance and delay, that in the points where rapid progress was immediately and directly essential, no considerable advance beyond the contract requirements had been obtained. During the year 1872, the advantages enumerated have been made so far available as to compensate many drawbacks and to avoid the necessity of providing larger and more costly pumping machinery at the central shaft, which would have been required in order to maintain continuous progress in both headings. The improved rates of regular progress attained made it possible to admit a very considerable discretion on the part of the contractor in the manner of prosecuting his work, and he has to a large extent been left to direct his efforts in the matter of progress as he thought most advisable.

In view of the various considerations mentioned, the original stipulations of the contract have been insisted on only so far as a due regard for the interest of the Commonwealth seemed to require. In some portions of the work the contractor has gone far beyond the requirements of his contract; in others he has fallen even more considerably behind them.

I furnish herewith a comparative statement up to January 1, 1873, showing quantities and values of the work of which the conditions of the contract would require execution, and also the amounts actually done up to that date. Similar

statements as to the progress in each succeeding year have been requested by previous committees. It will be found of interest in affording means for a study in detail as to the value of the progress hitherto made, and the expectations which may reasonably be entertained in regard to work yet unaccomplished.



## COMPARATIVE STATEMENT

*Of Work required by the Contract, and Work actually done at the Hoosac Tunnel, up to January 1, 1873.*

ITEMS THAT MAY NOW BE INCLUDED IN REQUIREMENTS OF PROGRESS UNDER THE CONTRACT.

SECTIONS.	Amounts of Original Estimate.		Contract time for Completion.		Total work required to be done to Jan. 1, '73, by terms of contract.		Amount of Work Actually Done to Jan. 1, 1873.	
	Quantities.	Prices.	Amount.		Quantities.	Amount.	Quantities.	Amount.
<i>East End Section.</i>								
Tunnel Enlargement,*	4,500	\$16 00	\$72,000 00	May 1, 1872,	4,500	\$72,000 00	3,915	\$62,365 00
Heading Enlargement,*	28,000	9 00	252,000 00	Aug. 1, 1872,	28,000	252,000 00	28,264	247,371 00
Tunnel Extension,*	85,100	11 00	936,100 00	Feb. 1, 1873,	83,192	915,096 81	85,469	924,440 25
Progress of Heading,†	5,335	—	—	Nov. 1, 1872,	5,335	—	5,991	—
Central Drain with Pipes,†	5,600	13 00	72,800 00	Feb. 10, 1873,	5,428	70,559 83	5,914	39,475 05
<i>Central Section.</i>								
Shaft repairing Timber,†	583	10 00	5,830 00	When ordered,	583	5,830 00	583	5,247 00
Trimming,*	100	33 00	3,300 00	"	100	3,300 00	90 <sup>78</sup> <sub>100</sub>	2,995 74
Sinking,†	447	395 00	176,565 00	May 1, 1870,	447	176,565 00	445	174,811 17
Sinking Sump,†	15	395 00	5,920 00	June 1, 1870,	15	5,920 00	83*	2,782 99
Pipes,*	1,030	6 00	6,180 00	June 1, 1870,	1,030	6,180 00	759	2,277 00
Fire-Proof Floor and Hatches,	—	—	2,000 00	When ordered,	—	2,000 00	—	1,650 00
Tunnel Extension, East,*	35,409	14 00	495,726 00	Sept. 23, 1872,	35,409	495,726 00	9,148	120,264 50
Progress of Heading,†	2,220	—	—	Sept. 23, 1872,	2,220	—	1,563	—
Tunnel Extension, West,*	46,861	14 00	656,054 00	July 1, 1873,	39,262	549,666 89	5,024	69,460 75
Progress of Heading,†	2,938	—	—	July 1, 1873,	2,480	—	345	—
Amounts carried forward,	—	—	\$2,684,475 00		—	\$2,554,844 53	—	\$1,653,140 45

\* Cubic yards.

† Lineal feet.

## Comparative Statement of Work—Concluded.

SECTIONS.	Amounts of Original Estimate.		Contract time for Completion.	Total work required to be done to Jan. 1, '73, by terms of contract.		Amount of Work Actually Done to Jan. 1, 1873.	
	Quantities.	Prices.		Quantities.	Amount.	Quantities.	Amount.
<i>Amounts brought forward,</i>	.	.	.	-	\$2,554,844 53	-	\$1,653,140 45
<i>West End Section.</i>							
Heading Enlargement,* .	52,800	\$9 75	March 1, 1874,	40,632	396,124 12	35,190	341,461 00
Tunnel Extension,* .	82,940	12 00	Nov. 1, 1873,	66,990	803,880 00	67,258	795,652 00
Progress of Heading, East,† .	5,200	-	Nov. 1, 1873,	4,200	-	4,648	-
Brick Work, M, .	4,500	22 00	Mar. 1, 1874,	3,434 <sup>254</sup> <sub>1000</sub>	75,553 58	3,539 <sup>837</sup> <sub>1000</sub>	77,876 41
Central Drain, with Pipe,† .	6,809	13 00	Mar. 1, 1874,	5,382	69,286 61	} 2,381	20,263 35
Excavation only,† .	1,516	4 35	Mar. 1, 1874,	1,138	4,945 50		
Masonry only,† .	1,516	3 00	Mar. 1, 1874,	1,138	3,410 82		
Haupt Tunnel Maintenance, .	-	-	Mar. 1, 1874,	-	5,625 06	-	7,433 00
	-	-		-	\$3,913,670 22	-	\$2,895,826 21

## ADDITION OF ITEMS NOT NOW INCLUDED IN REQUIREMENTS OF REGULAR PROGRESS UNDER THE CONTRACT.

<i>East End Section.</i>							
Covering old Drain,† .	5,500	\$1 25	March 1, 1874,	-	-	-	-
<i>Central Section.</i>							
Central Drain, with Pipes,† .	5,154	13 00	March 1, 1874,	-	-	-	-

*West End Section.*

Covering old Drain,†	2,500	\$1 25	\$3,125 00	March 1, 1874, When ordered, “	—	—	—	—	\$155 00
Stone Arch,	—	—	23,000 00	“	—	—	—	—	—
Western Facade,	—	—	26,000 00	March 1, 1874,	—	—	—	—	—
Railway Track, miles,	4 $\frac{3}{4}$	14,000 00	66,500 00						
	—	—	\$4,594,268 00		—	\$3,913,670 22	—	\$2,895,981 21	
Deduct for embankment above grade at East End, . . . . .									
							\$1,546 50		
Deduct labor and material furnished by Commonwealth, . . . . .									
							8,403 80		
Amount of Estimates,	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	9,950 30	\$2,886,030 91	

\* Cubic yards.

† Lineal feet.

I will here add, in continuation of the series of statements heretofore given, the financial exhibit showing the present relation of the Commonwealth to Messrs. Shanly for account of the work of their contract.

*Statement as to total work done, and payments made on contract of W. and F. Shanly for completion of the Hoosac Tunnel, including the payment of January 15, on estimates for work up to January 1, 1873.*

Whole amount of Shanlys' contract,	\$4,594,268 00
Deduct work and materials supplied by the State,	8,403 80

Value of work undertaken by W. and F. Shanly,	<u>\$4,585,864 20</u>
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Up to the 1st January, 1873, the Messrs. Shanly have executed work to the estimated value of	\$2,886,030 91
And they have received for account of the above, including the payment of January 15th, for the last estimate rendered up to January 1st, $\frac{4}{5}$ or 80 per cent. of the amount,	<u>2,308,824 73</u>

Leaving amount reserved under the original stipulation of the contract,	\$577,206 18
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Out of this amount reserved, there has been loaned to them under the provisions of chapter 47 of the Resolves of 1872 the amount of \$100,000 upon a mortgage of their machinery : and there have also been issued to them under the same Resolve, in partial account of the above reserve certificates of indebtedness to the amount of \$200,000, the payment of which is made conditional upon their completing the whole work of their contract. Of those, however, they are understood not to have made use.



With the single exception of progress westward from the central shaft, which was suspended in February, the advance of the past year in the work of driving the headings may be said to have been substantially without peculiar hindrances, and the results obtained have satisfied the most sanguine anticipations. In the heading from the west end up to January 1, 1872, the whole length obtained was but 32 feet in excess of the contract requirement. For the year following the contract would require a progress of 1,200 feet. The actual length penetrated was 1,616 feet, an excess of more than 33 per cent. This very favorable result is paralleled as to ratio between required and actual rates, by the very creditable as well as very fortunate progress which has been accomplished through extraordinary efforts in the heading eastward from the central shaft. In this the contract rates would require, for the  $11\frac{1}{2}$  months' work which preceded the junction made with the east end section, December 12th, a length of 920 feet; and the actual amount accomplished was 1,226 feet; an excess of very nearly 33 per cent.)

A year since there had been obtained the very trifling aggregate excess of thirty-two feet beyond contract rates at only one essential point of progress (in the west end heading), while considerable deficiencies existed elsewhere.

There were then to be apprehended all the risks of possible interruption in the central section—which have been happily escaped, and are now finally removed by the extension of the opening from the east end, which joins and drains the gallery of the central division of the Tunnel.

It did not seem prudent at the beginning of the year to compute the expected progress upon the basis of assuming greater average rates of advance than were established by the contract. The largely fortunate results already enumerated, so far exceeding those of our previous experience, seem to have been obtained with exemption from the contingencies and delays which usually attach to works of this description, and might have been deemed matter of special apprehension in conditions of progress during the past year. It should, however, be remembered that the extraordinary progress is due largely to the extraordinary exertions made. The main sources of apprehended hindrance being now removed, we

may reasonably expect henceforward progress even better than that here recorded for the year just passed.

The details of prosecution of the work during the past year have not seemed so much varied from those of preceding years as to make an extended relation a matter of interest.

The Deerfield River has maintained a more than usually constant regimen of flow, which has been most of the time sufficient for moving the turbine wheels attached to compressors with the force needed for producing air pressure to be transmitted through the mains and used for driving the machine drills at heading and enlargement faces.

In the progress of the heading from the east end during the year, the rock has been more unfavorable for excavation than heretofore, rather by reason of the direction of its stratification than any considerable difference of formation. The advance obtained has been but little beyond the specified rates of contract. The need of a more powerful explosive than the common blasting powder heretofore employed has been indicated by the diminished progress since the commencement of the year, but excepting some occasional trials with nitro-glycerine which were not sufficiently regular and continuous for any definite result, no special action was taken until the latter part of October when some trials were made with Giant-powder. These proved sufficiently favorable to induce its further use during November and the early part of December, and considerably increased rates of progress were attained thereby.

The junction made of the heading from the east end with the portion of gallery or heading which had been driven eastward from the central shaft was made December 12th at an intermediate point distant 11,274 feet from the east portal, and 1,563 feet from the central shaft. By this connection of the galleries the water is made to discharge eastward, flowing out from the east portal toward the Deerfield. The heavy continual cost heretofore involved in lifting it through the shaft is avoided, and we henceforth escape the grave risks heretofore imminent either from derangement of the pumping machinery or from piercing water-veins which might overtax its margin of capacity.

Since the junction was effected, the duty of the pumps has been limited to the trifling work of lifting the water which makes in the central section, over the bench of rock about twelve feet high which had been left in the Tunnel eastward of the shaft.

The work of excavating this bench has been commenced at both its faces and its early removal will soon obviate the necessity even for this slight duty.

Immediately after the meeting of the headings had been accomplished as above described, preparations were made to commence again the advance westward from the shaft. This had been suspended during the February preceding, in consequence of the apprehensions, occasioned by late increase of the water-flow, that further progress might develop such increased amount as should occasion a drowning out of the central shaft drifts, and consequent suspension of progress east; which it was deemed essential to maintain.

During the latter part of December a progress of twenty feet westward from the central shaft was made, and the continuous length from the east end laid open up to January 1, 1873, was . . . . . 13,196 feet, made up as follows :

By heading driven from east end, .	11,274	
By heading driven from central shaft		
eastward, . . . . .	1,563	
By heading driven from central shaft		
westward, . . . . .	359	
making the aggregate, . . . . .	—	13,196 feet,
as above stated.		

The length penetrated from the west end up to the same date was . . . . . 8,706 feet.

And the length of the mass of rock yet to be penetrated in order to complete the opening through the tunnel was . . . . . 3,129 “

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Making the total length of Tunnel . . . . . 25,031 feet,

or forty-nine feet less than four and three-quarters miles.



The excellent rate of progress attained by the west-end heading during the year, has been before referred to in the general statement. The works of enlargement and the more immediately essential portion of the work of trimming to full Tunnel size have kept pace with the above. The building of the brick arch has been extended during the year for a distance of  $226\frac{1}{2}$  feet, giving a total length of 2,201 feet of brick arch extension into the tunnel from the west end, of which 1,270 feet have been built by the Messrs. Shanly under their contract.

Mention has been already made of the junction made in December between the heading advanced from the east end and that which was driven in an opposite direction from the central shaft to the point of meeting. Beside the important benefits of removing a great source of expense and apprehensions of serious hindrance and delay, the event involved another feature of considerable interest, in affording the long-expected opportunity of proving the correctness of lines heretofore separately established, and for years separately maintained, for guiding the work. The results obtained show these lines to have been traced without deviation exceeding the fraction of an inch; although the longer one had been extended for a distance of 11,274 feet, or about two and one-eighth miles, from the eastern portal, and for the other, 1,563 feet long, the interval between the plummet lines, carried down to the depth of 1,028 feet below surface in order to establish the initial direction at the bottom of the shaft, was but twenty-three feet.

*Railroad between the West End of the Tunnel and North Adams.*

Work on their contract of date of December 27, 1871, was commenced by McClallan, Son & Walker, the contractors, in the early part of January, 1872. On the work of graduation they have made excellent progress, except in the approach cutting to the west portal of the Tunnel. In this less progress has been made than could be desired, owing in part to the unfavorable nature of the material encountered, and partly to the fact of their having been hindered for a time, from having confided the execution to parties favorably known



elsewhere, but who proved not competent to encounter the increasing difficulties.

So soon as it became evident that the sub-contractors would not be able to accomplish the work with sufficient expedition, Messrs. McClallan took prompt measures to terminate the bargain with these parties, and by the end of December had perfected all arrangements for taking the work and force again into their own control with the commencement of the new year.

Before the inability of the sub-contractors to make adequate efforts had been fully evinced, the evident difficulties of the excavation showed that some unusual measures for expediting the work should be undertaken. In view of this, the Messrs. McClallan commenced, and nearly completed during December, at their own cost, the removal of earth and rock for a cross-cut or passage of sufficient width for their grading cars, which leads from the abandoned road-way built by Haupt, north-easterly to the line of railroad now located in the centre of the length of excavation which they have yet to execute.

Thus affording the means to reach and apply their gangs at another part of the approach cutting, they can at any time employ with profit double the force previously available, and will probably be able to complete this railroad cut long before the occasion for its use shall arise.

In the work of masonry, the contractors have completed, or nearly completed, three culverts or cattle ways, and one of the large bridges. Unless some unusual difficulties are met with, it would seem that the arrangements made will secure the final completion of all the masonry during the year 1873.

Very respectfully,

Your obedient servant,

BENJ'N D. FROST, *Engineer.*



# R E P O R T

ON THE

## TROY AND GREENFIELD RAILROAD AND HOOSAC TUNNEL,

BY THE

JOINT STANDING COMMITTEE,

FOR 1873.

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BOSTON:

WRIGHT & POTTER, STATE PRINTERS,

79 MILK STREET (CORNER OF FEDERAL).

1874.





## Commonwealth of Massachusetts.

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To the Honorable GEORGE B. LORING, *President of the Senate.*

SIR :—I have the honor herewith to transmit the Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel for the year 1873.

Your obedient servant,

ROBERT JOHNSON, *Chairman.*

BOSTON, April 10, 1874.

## Commonwealth of Massachusetts.

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The Joint Standing Committee, for the year 1873, on the Troy and Greenfield Railroad and Hoosac Tunnel, herewith submits its Report concerning the various operations of progress toward the completion of that enterprise, which have been accomplished during the year.

The recent removal of the final barrier at last enables us to record the establishment of a continuous opening for the entire length of the Tunnel through the Hoosac Mountain. All the doubts with which timidity or adverse prejudice has hitherto invested this undertaking are at last dispelled, and it now remains only a question of months, more or less, of further operations, to reach the time when the people of the Commonwealth shall commence to enjoy the practical benefits of the continuous route.

Its accomplishment has been the object, from an early day, of the hopes and labors of many of her best citizens; and it is a matter of yet recent remembrance how much their persistent pursuance of this project has availed to remove honest doubts and fears and compel sometimes reluctant faith.

As the work approaches completion, in place of the few who at first appreciated, despite all discouragement, the possibilities of the future, and pressed on with this undertaking in the face of ridicule and hostility, the whole community now perceives its value, and is weighing with anxious care how best to manage and develop its vast capacities of benefit to the Commonwealth.

It would be a pleasant and an interesting history to recount the names and labors of those whose efforts have been the most effective and conspicuous for this result. Like all those who devote their exertions to permanent and substantial

objects, they will have their best memorial in the success of their enterprise and the advancement of its purposes.

As citizens of Massachusetts, we rejoice to contemplate, as being no longer a matter of remote anticipation, the very early establishment of this railroad route.

Actually extending from the western boundary to the central valley of the Commonwealth, it is practically prolonged by the adjacent lines at either end, already built by the wise foresight of private capital, so that its approaching early completion will establish a continuous low-grade avenue from the Hudson River to the harbor of Boston.

The great practical questions of policy in operating it do not fall within the province of our inquiry, and are elsewhere receiving the attention to which they are entitled. We confine ourselves therefore to a review of the works of construction accomplished during the year, and of the general condition of the line as to completeness, character and sufficiency.

A special examination and report of recent date (House Doc., No. 9, 1874), describing the deficiencies and discussing remedies needed on the already operating portions of the state road, is before the legislature for consideration, and therefore relieves us from proceeding with that branch of the subject.

We will now mention in successive order the several divisions of the route which it seems convenient to establish for the purposes of present description.

### *Railroad East of the Tunnel.*

The length of track now laid down, extending from Greenfield to the Hoosac Tunnel station, has been duly cared for by the railroad companies who hold and operate it under the conditions of their lease from the Commonwealth.

The unfinished portion of the railroad, extending from the end of track above mentioned to the eastern end of the Hoosac Tunnel, embracing the distance of about two-thirds of a mile, has been particularly described in the report of the chief engineer, which is herewith appended. The comparatively small amount of work yet incomplete is understood to be in progress, and its details appear to call for no special remark.

Under the denomination of "*accessory works*," in this connection, should be mentioned the matter of the highway now building across the State land, near the east end of the Tunnel.

Our predecessors, in their report covering the operations of the year 1872 (Senate Doc., No. 201 of 1873), made brief mention of its objects, and recommended that the unexpended balance of the appropriation for this purpose, made in chapter 256, section 3, Acts of 1870, be made available by further legislation. It was, however, concluded by the legislature to embrace in a single appropriation the whole amount immediately requisite for the Tunnel and accessory works.

The conditions which have caused a delay in the building of a portion of this highway are duly stated by the engineer. The necessary preceding conditions of filling the waste banks having been attained, the length yet unfinished may be completed during the approaching summer.

*Contract-work for Completion of the Hoosac Tunnel.*

The progress of the last year has been largely free from exceptional sources of hindrance or difficulty. The contractors, Messrs. Walter and Francis Shanly, seem to have continued to maintain a high standard of diligence and energy in the prosecution of their work. Relieved from the sources of exceptional delay and expense at the central section, hitherto so serious, they have been able to produce results more fully satisfactory to the public expectation, by removal of quantities of material largely exceeding those of previous years.

Without here entering into any detail of the facts and circumstances attending their operations, it is sufficient to state that the value of work accomplished by them during the year 1873 has exceeded by nearly one-seventh that of the previous year. If their further labors were confined only to the work which appears to have been contemplated at the time of their undertaking the contract, it seems entirely probable that they would be able to complete its execution before the expiration of the six months' margin beyond March 1, 1874, which the contract permits to be allowed them.

It has been found, however, that in that portion of the Tunnel where the rock was originally expected to be sufficiently



compact for the maintenance of a natural roof, certain lengths will require the artificial support of brick arching. This involves the cost of removing an increased quantity of rock, and of supplying materials and labor for building the arch. The contractors claim that this was not anticipated by the contracting parties, and was not therefore embraced by them in making up their estimates of the price at which they contracted to build the Tunnel, and should be paid for as extra work.

Since the amount provided by legislative enactment for the contract only affords compensation for the work of the Tunnel originally designed, justice and equity toward the contractors may commend to the consideration of the legislature the further appropriation of an amount sufficient to provide for the cost of the additional constructions.

It has been a matter of advantage to the enterprise that the contract for its execution should have fallen into the hands of men alike energetic and competent, who have contended successfully with its many difficulties.

The report of the engineer gives succinct description of the works which have been accomplished during the past year in making a new artificial channel for a portion of the length of Tunnel Brook, near the western end of the Tunnel. The damage occasioned by this stream during the freshet of October, 1869, will be remembered by those of your Committee who have visited the locality, and who, after sufficient examination of the matter, feel able to indorse the propriety and necessity of the expenditure which has been incurred, as the only means of securing a permanent safety.

In the appended report of the chief engineer will be found a somewhat extended account of the contract operations of the past year in the Tunnel, which seems to embrace such details of the work as are most likely to be of general interest. He has therein given some very carefully prepared statements, in tabulated form, to which we would refer, as affording a very perspicacious exhibit of the progress and value of the work accomplished during the successive years of the present contract.

We would also commend to the attention of all interested in such matters the statements in the engineer's report, which

exhibit the precision attained in the instrumental operations by which the alignments, grades and distances were established.

When it is remembered that the joining of the lines of the Mt. Ceniz Tunnel showed a variation of a little more than half a yard, it will be regarded as a source of just pride by our engineers and of just satisfaction by the community, that in the case of the Hoosac Tunnel this variation has been reduced to the almost imperceptible difference of the mere fraction of an inch in each instance.

#### *Railroad between the Tunnel and North Adams.*

The work under the existing contract for grading the roadway has not, during the year, advanced so rapidly as was desired and expected. It is, however, a matter of simple justice to Messrs. McClallan, Son & Walker, contractors, that we mention the occurrence of unusual difficulties in the nature of the work, which seemed partially to excuse, but not justify, the whole amount of delay. The assurances of extraordinary effort which the contractors have given, and the fact of the special constructions already undertaken by them, at a considerable pecuniary outlay, for the purpose of expediting the completion of their contract, afford reasonable belief that they will finish their work before the occasion for occupying that portion of the roadway can arrive.

#### *Railroad West of North Adams.*

The portion of the railroad which extends from North Adams to the junction at the state line with the track of the Southern Vermont Railroad, is now leased and operated by the Troy and Boston Railroad Company.

The lease (which was executed by the Troy and Greenfield Railroad Company prior to the surrender of their franchise to the State) will terminate on completion of the Tunnel, and possession of the line will thereby revert to the Commonwealth.

Since the length in question forms virtually an extension of the Troy and Boston Railroad from the state line, eastward to North Adams, it is obviously for the interest of that corporation to obtain the extension of this lease.

The Troy and Boston Railroad was built with the purpose of making a connection with the Troy and Greenfield Railroad line, in order that, upon the completion of the Tunnel, there should be a continuous road to the Hudson.

It is to be hoped that the present owners of the Troy and Boston road may hold the same purposes which were entertained by its original projectors, and recognize that their interests are so largely dependent upon and associated with those of this Commonwealth, that they will be best promoted by harmonious concurrence with such policy as the latter may elect and pursue.

Having thus suggested the various considerations and details concerning this enterprise which seem to us most deserving of special remark within the scope of our supervision, we submit them with the hope that they may be of some value in exhibiting its present condition.

Believing that it can be so completed and managed as largely to promote the interests of the Commonwealth, we shall regard with lively interest the further measures which may be undertaken for the purpose of accomplishing its most complete and efficient development.

ROBERT JOHNSON,  
RUFUS D. WOODS,  
EDW'D LEARNED,

*Of the Senate.*

WILLIAM C. PLUNKETT,  
T. S. WHITE,  
WEAVER OSBORN,  
BROWNELL GRANGER,  
JOHN W. FLETCHER,  
GEORGE H. WHITMAN,  
AMOS HILL,  
ALMOND R. LANCASTER,

*Of the House.*

ENGINEER'S OFFICE,  
HOOSAC TUNNEL AND TROY AND GREENFIELD R. R., }  
NORTH ADAMS, MASS., March 20, 1874.

*To the Joint Standing Committee for the year 1873 on the Troy and Greenfield Railroad and the Hoosac Tunnel.*

GENTLEMEN :—In compliance with your request, I have prepared the following Report concerning the work accomplished during the year 1873 upon the Tunnel and adjacent portions of the railroad now under construction, and the progress toward completion attained up to January 1, 1874 :—

On the division of the Troy and Greenfield Railroad east of the Hoosac Tunnel, the whole length of a little more than thirty miles, extending from Greenfield to Hoosac Tunnel station, was first completed in 1868, and, with exception of the interruption caused by the freshet of October, 1869, has since been held and operated by the Fitchburg and the Vermont and Massachusetts Railroad Companies.

The track now laid down and in use, as above stated, terminates at a point 3,295 feet distant from the east end of the Hoosac Tunnel, and the work of building the roadway extending thence to the entrance of the Tunnel embraces the following constructions :—

*First.* The cutting through a point of the mountain which is usually designated as "Rowe Head," and the short adjacent work of embankment made by deposit of the material excavated.

Next in order, going westerly, occurs the very considerable length of high embankment which has been made by dumping the larger portion of the rock which has been hauled out of the east end of the Tunnel by F. Shanly & Co. in the prosecution of their existing contract.

Following this comes the railroad bridge over the Deerfield River, completed in 1869, for which contracts were made and the work of building commenced under authority of the state commissioners in 1868, which was the last year of their term of office.

From the river-crossing to the Tunnel, a temporary road was made many years since, over which the contractors' track now passes ; but this is neither at proper grade nor of sufficient width, and, consequently, further work of excavation and filling is required to complete the permanent way.



The previous contractor for the rock-cutting just west of the railroad station having unnecessarily delayed to prosecute the work during the present season, the abandonment of his contract was declared, under its provisions, with forfeiture to the Commonwealth of the amount yet reserved and unpaid—twenty per cent. of the value of work heretofore accomplished by him. Subsequently to this, advertisement for proposals was made, and a new contract entered into with George West for the completion of the remaining work, and under this contract the grading of that portion of the road was completed.

The channel of Cascade Brook passes near the east portal of the Tunnel. Previous to deposit of any material from the excavations, it had crossed the line of railroad location before discharging its waters into the Deerfield River. During all the years of the construction of the Tunnel, it has hitherto been in times of flood a source of apprehension, and occasionally of actual interruption to the workings. This was notably the case in October, 1869. After that occurrence, the present contractors thoroughly repaired and strengthened the wall or dike which had been built many years previous, by forces under state employ, to protect the roadway leading into the Tunnel from inundation; and they thereby obtained such approximate security as might be gained within the limits of cost which they deemed it suitable to incur.

Since the position of the provisional barrier invaded a portion of the space ultimately designed for occupation by the permanent way of the railroad, it could not be made available in the system of final occupation.

The constructions necessary to make suitable disposition of the waters of this brook, have been undertaken, and advanced very far toward completion during the past year. The discharge of the stream is now directed through a culvert, built in such position as to admit of its being overrun by the side-tracks that will hereafter be found requisite for the purposes of railroad occupation. At the close of the year, there remained only a small portion of the intended construction yet incomplete. It is intended to resume and finish this at such early opportunity of the ensuing summer season as shall be found least likely to

interfere with the intended prosecution of tunnel and railroad works which it is required to accomplish.

*Highway across the State Lands at East End of the Tunnel.*

The building of the road was commenced in 1870 by order of the governor and council, under the specific appropriation made in chapter 252 of Acts of 1870. Of this there was built, in 1870, forty-eight rods, and in 1871 four and a half rods, making the aggregate length of fifty-two and a half rods, which has been designated as the northern division of the highway.

The location of this was determined by the county commissioners of Berkshire County, being the southern portion of a route established by them, extending up the valley of the Deerfield River to the northern line of Berkshire County.

The building of the county road northward from the northern boundary of the state lands was begun in 1871 and finished early in the year 1872.

From the southern boundary of the state lands, up to the south end of the northern division of the highway, built as described in the foregoing, an old town way (extended by a road which had been built for the purpose of facilitating the Tunnel operations) has afforded a means of present travel, which has been used, without very serious remonstrance, by the inhabitants of the upper valley of the Deerfield and others who have found occasion to traverse the route.

In order to secure the best location, and at the same time keep the limits of estimated cost within the sum of \$1,500 provided by the legislature for this highway, the commissioners were obliged to establish parts of the line extending over low grounds, which it was proposed to fill by deposit of material brought from the excavations of the Tunnel, with the expectation that the building of such portions of the highway would be deferred until the sufficient completion of these requisite fillings.

During the past year a further length of highway of seventy-six rods, extending over a portion of the fillings, has been partially ballasted so as to allow its being brought into use for travel, and all the necessary fillings are now so nearly finished that the completion of the highway may be regarded as one of the expected results of the present year's operations.

*Hoosac Tunnel.*

The operations of the contractors for the past year have been much more productive, with regard to force employed, than those of any previous year.

By the junction, accomplished December 12, 1872, of the eastward heading from the central shaft with the heading advancing westward from the east end, the continuous gallery for the discharge of drainage eastward was established. This relieved the contractors from that date forward of the greater portion of the cost of pumping. Heretofore they had been compelled to raise all the water that accumulated in the central section through a vertical lift of 1,009 feet up the central shaft to the outlet pipe toward a discharging culvert built beneath the surface, which conveyed the flow into a neighboring ravine.

Thenceforward the requisite removal of water, so as to permit the work of driving the eastward breast of enlargement and of the westward heading (both of which had been started from the central shaft at grade of the floor of the Tunnel), involved only pumping up a lift of twelve feet to the top of the bench of rock which had been left under the floor of the heading previously driven. This floor followed the regular descent of grade, and thus afforded natural flow eastward.

The entire removal of this bench was accomplished during the month of June following. The need of pumps was thereby obviated, and the water which made in the workings near the central shaft was left free to follow the floor of the Tunnel to discharge out of the east end.

No specific mention was made in my report for the year 1872, of the quantities of water encountered by the workings from central shaft, and necessarily removed by pumping or bailing.

At suggestion of one of your number, I repair the omission in the previous report. The following tabulated statement gives a sufficient exhibit of the quantities of flow in successive stages of the workings of that year.

*Partial Record of Observations exhibiting the variations of quantities of flow of water in Central Section during the year 1872.*

DATE OF OBSERVATION.	Flow in Gallons per minute, all pumped or bailed out through the Central Shaft.	DATE OF OBSERVATION.	Flow in Gallons per minute, all pumped or bailed out through the Central Shaft.
<b>1872.</b>		<b>1872.</b>	
Jan. 1, .	$81\frac{9}{10}$	Apr. 20, .	$132\frac{7}{10}$
17, .	$87\frac{9}{10}$	May 1, .	$146\frac{2}{10}$
18, .	$90\frac{9}{10}$	22, .	$205\frac{8}{10}$
22, .	96	23, .	$237\frac{5}{10}$
24, .	$110\frac{26}{100}$	June 10, .	$237\frac{6}{10}$
Feb 1, .	$104\frac{15}{100}$	19, .	$214\frac{1}{10}$
15, .	$122\frac{5}{10}$	22, .	$208\frac{5}{10}$
22, .	$108\frac{7}{10}$	29, .	$202\frac{8}{10}$
Mar. 22, .	$106\frac{4}{10}$	Oct. 8, .	$208\frac{79}{100}$
Apr. 6, .	$137\frac{47}{100}$	Dec. 12, .	<div> <div></div> <div>Last day of pumping through the Central Shaft.</div> </div>
15, .	$136\frac{2}{10}$		

I shall afford perhaps a still better general impression of what was necessarily accomplished in the central shaft by the following statement of quantities of rock and water lifted during the term of pumping in the year 1872, extending from January 1 to December 12 :—

Number of tons of rock lifted, . . . 13,792  
 “ “ of water lifted, . . . 315,095

This, however, gives no idea of the peculiar difficulties and costly interruptions of the work, occasioned by the intrusion of large and increasing volumes of water. These should fairly be remembered and considered in estimating the exertions made by the contractors to expedite the work.

During earlier months a force has been employed in the breast of roof enlargement east of the bench, and the work was substantially completed in the latter part of November,



1873, thereby, in connection with the results of other workings also driven, affording nearly a full-size tunnel, extending from the central shaft to the east end, with only such remaining masses of loose material or projections of unblasted rock as belong to the later labor of the mucking and trimming gangs.

West of the central shaft, the westward penetration of the heading, which had made but trifling advance since February, 1872, was recommenced in December, 1872, and thence vigorously and continuously prosecuted up to November 27, 1873. By that date it had approached so near the breast of the opposite heading (which had been driven with easterly direction from the west shaft) that the intervening mass was readily broken through by charges of nitro-glycerine, which were loaded into each of the breasts and simultaneously fired on the afternoon of that day.

By this event, most interesting to those immediately connected with the work, the final barrier was removed, and a continuous way of passage afforded from the valley of the Deerfield to the valley of the Hoosac, on the actual subterranean road which is hereafter to become a thoroughfare of traffic.

The working progress of the contractors in the Tunnel during the year has shown comparatively a brief record of the accidents, more or less disastrous, which are to some extent inseparable from any work of this character. The most serious occurrence, involving loss of life, was that which took place on the 30th of June, on a train of cars which was being drawn inward from the east portal, when five persons were killed by the explosion of giant-powder. This material was being carried to the work in an open box, placed upon a car shortly in rear of the locomotive, and the impression prevails that the ignition of some exploders lying on the top of the box by sparks from the locomotive was the primary cause of the accident. It would probably not have occurred if the giant-powder alone had been thus exposed.

The modes of working pursued in the various portions of the Tunnel excavation during the past year were generally similar to those heretofore adopted, and present but little occasion for special remark. It is only in the matter of em-

ployment of explosives that any material change has been made. Giant-powder (a compound of nitro-glycerine) was substituted successively at different points of working, in place of the nitro-glycerine heretofore in use, with economy in the ordinary progress of enlargement. Writing at this date, however, it becomes appropriate for me to mention also in this connection that the results of the more recent introduction of Mowbray's mica-powder (also a compound of nitro-glycerine) seem to indicate the probability of its superseding the use of giant-powder for the completion of the Tunnel.

Nearly all the exploders used for firing the blasts have been, as heretofore, those manufactured by Charles A. Browne & Brother.

An interesting circumstance, not heretofore referred to, is that of the extension during the past year of the lengths of pipe-main through which the compressed air, afforded by compressors driven by turbine wheels at Deerfield River, is now conveyed and utilized at very considerable distances. Early in July, the pipes in the eastern section were connected with those of the central section workings, which had been heretofore supplied only from the steam compressors at top of the shaft. In favorable times thereafter, the working of the steam compressors was wholly suspended, and the power-drilling at headings was accomplished with pressure created at the Deerfield River wheel-house, about three miles distant.

Below is presented a tabulated statement of the lineal feet of heading or shaft driven, and of the amounts earned by the Messrs. Shanly in each of the successive years since the commencement of their work under the contract, by which it will appear that they have earned, in 1873, \$114,802.13, or nearly one-seventh more than during 1872 :—

*Statement of Work done during the years 1869, 1870, 1871, 1872, and 1873, and of work remaining out of the quantities originally estimated as required to be done under F. Shanly & Co.'s contract for completion of Hoosac Tunnel.*

	Work done in 1869.	Work done in 1870.	Work done in 1871.	Work done in 1872.	Work done in 1873.	Balance remain- ing, January 1, 1874.	Estimated Amount of Con- tract.
Lineal feet of Headings, . . .	1,688	2,864	3,553	4,456	3,132	—	15,693
Value of Tunnel Work, . . .	\$405,948 23	\$715,680 96	\$756,981 75	\$826,059 87	\$940,862 00	\$682,440 19	\$4,327,973 00
Lineal feet of Shaft to grade, . . .	215	230	—	—	—	2	447
Value of all Shaft Work, . . .	\$92,271 24	\$94,223 67	\$3,268 99	—	—	\$10,031 10	\$199,795 00
Railway Track, . . . . .	—	—	—	—	—	66,500 00	66,500 00
Deduct work and material furnished by State, . . . . .	\$498,219 47 5,830 70 \$492,388 77	\$809,904 63 2,573 10 \$807,331 53	\$760,250 74 — \$760,250 74	\$826,059 87 — \$826,059 87	\$940,862 00 — \$940,862 00	\$758,971 29	\$4,594,268 00

I give beneath also an exhibit of the respective lengths of headings driven from each of the starting-points of working, making up the several aggregates of lineal feet of annual progress which have been shown in the preceding statement:—

ADVANCE OF HEADINGS.		In 1869.	In 1870.	In 1871.	In 1872.	In 1873.
From East End,	. . . . .	1,239	1,514	1,743	1,495	—
Central Shaft,	{ East, .	—	60	277	1,226	—
	{ West, .	—	87	153	119	1,697
West End,	. . . . .	449	1,203	1,380	1,616	1,435
Aggregate lineal feet,	. . . . .	1,688	2,864	3,553	4,456	3,132

Total amount of the headings driven by F. Shanly & Co., . 15,693

I also supply a general statement in detail of the different descriptions of work involved in the contract, exhibiting the amounts originally estimated as required for completion of the Tunnel, and the total amount actually accomplished by the Messrs. Shanly up to January, 1874.



## GENERAL STATEMENT.

Showing the work originally estimated as requisite for Completion of Hoosac Tunnel, and the Work done up to January 1st, 1874.

DESCRIPTION.	Amounts of original Estimate.		Contract time for Completion.	Amount of Work done to Jan. 1, 1874.		Balance of Quantities originally estimated.	
	Quantity.	Amounts.		Quantities.	Amounts.	Quantities.	Amounts.
<i>Tunnel Excavation, with drainage.</i>							
East End Enlargement in ground opened by State Heading.	32,500	\$324,000 00	Aug. 1, 1872,	32,398	\$320,805 75	102	\$3,194 25
Tunnelling work in ground opened by F. Shanly & Co.,	250,310	3,083,160 00	Nov. 1, 1873,	234,066	2,775,671 75	16,244	307,488 25
West End Enlargement in ground opened by State force,	52,800	514,800 00	Mar. 1, 1874,	40,476	391,646 75	12,324	123,153 25
Drainage,	17,567	228,371 00	Mar. 1, 1874,	9,554	66,896 25	8,013	161,474 75
Excavation and masonry,	3,032	11,142 00	Mar. 1, 1874,	-	-	3,032	11,142 00
Covering old drain,	8,000	10,000 00	Mar. 1, 1874,	-	-	8,000	10,000 00
Carried forward,	.	\$4,171,473 00	.	.	\$3,555,020 50	.	\$616,452 50

GENERAL STATEMENT.—*Concluded.*

	DESCRIPTION.	Amounts of original Estimate.		Contract time for Completion.	Amount of Work done to Jan. 1, 1874.		Balance of Quantities originally Estimated.	
		Quantity.	Amounts.		Quantities.	Amounts.	Quantities.	Amounts.
<i>Brought forward,</i>	.	.	\$4,171,473 00	.	.	\$3,555,020 50	.	\$616,452 50
<i>Accessory Works.</i>								
In East End Section,	None,	—	—	—	—	—	—	—
	Repairing timber work,	583	5,830 00	When order'd,	583	5,247 00	—	583 00
In Central Section,	Trimming,	100	3,300 00	When order'd,	90 <sup>78</sup> / <sub>100</sub>	2,995 74	—	304 26
	Sinking,	447	176,565 00	May 1, 1870,	445	174,811 17	—	1,753 83
	Sinking Sump,	15	5,920 00	June 1, 1870,	83 <sup>ce</sup> . yds.	2,782 99	—	3,137 01
	Pipe, 2 of 10 in. dia.,	1,030	6,180 00	June 1, 1870,	759	2,277 00	—	3,903 00
	Fire-proof floor & hatches,	—	2,000 00	When order'd,	—	1,650 00	—	350 00
In West End Section,	Brick work,	4,500 <sup>m</sup>	99,000 00	Mar. 1, 1874,	3,539 <sup>887</sup> / <sub>1000</sub>	77,876 41	960 <sup>163</sup> / <sub>1000</sub>	21,123 59
	Stone arch,	50	23,000 00	When order'd,	—	5,771 40	—	17,228 60
	Western facade,	—	26,000 00	When order'd,	—	—	—	26,000 00
	Haupt Tunnel, maintenance,	—	8,500 00	Mar. 1, 1874,	—	8,411 00	—	89 00
Through whole length of Tunnel,	Railway track,	4 <sup>3</sup> / <sub>4</sub>	66,500 00	Mar. 1, 1874,	—	—	4 <sup>3</sup> / <sub>4</sub>	66,500 00
Aggregates,	.	.	\$4,594,268 00	.	.	\$3,836,843 21	.	\$757,424 79

I have here to remark—in reference to that portion of the statement which exhibits the original estimate of contract-work required—that the subsequent excavations have gradually developed the necessity of building brick arching in portions of the Tunnel where no such requirement was included in the original estimate.

It follows, of course, that this additional amount of arching will increase, to a proportional extent, the total cost to the contractor of completing his work.

As the excavations are not yet so far complete as to enable me to determine otherwise than approximately the lengths for which this additional support must be furnished, and for the further reason that a legislative committee is now considering the contractors' application to be compensated therefor, I do not here attempt any new statement of quantities.

During the past year no arching has been built. There remains on hand a supply of nearly 900,000 bricks of last year's make in the brick-yard near the west end.

Mention was made in the last annual report of the correct position of the working lines established in the eastern division of the Tunnel, which had been respectively extended from the east portal westward and from central shaft eastward, which was finally proven after the meeting of the headings (accomplished Dec. 12, 1872) gave opportunity for the determination.

A result showing similar exactness in the working lines in the western division of the Tunnel, has been afforded by the meeting accomplished Nov. 27, 1873, at a point distant 2,056 feet, or a little more than three-eighths of a mile west from the central shaft, and 10,138 feet, or a little more than  $1\frac{9}{10}$  miles from the west end.

At this meeting point, the shorter working line tested by the determining points of central shaft and east end was known to be in exact position; and the longer line of  $1\frac{9}{10}$  miles was found to have deviated only by the amount of nine-sixteenths of an inch.

These results of accuracy are believed to surpass any yet attained in other works of similar character. They are the expected and legitimate fruits of an amount of care and labor which can hardly be appreciated. I necessarily pre-

scribed the methods to be pursued, and at the outset gave much personal attention to the instrumental operations, but in the later accumulation of other duties have found it possible to give only so much of my time to this one matter as was needful to secure personal knowledge that the requisite processes were faithfully and correctly carried forward.

In these and other labors I have had the constant pleasure of observing the admirable fidelity and zeal of my several assistant engineers, Messrs. F. D. Fisher, Carl O. Wederkinch and A. W. Locke, respectively in charge of the west end, central and east end sections; and I wish further to commend the several subordinate assistants and inspectors for faithful and willing service under the protracted exposures and hardships of their work. It has been my necessary responsibility to select those who should aid me in carrying out the various departments of my engineering work, and I am now gratified to accord such unreserved praise to the members of my corps for the meritorious discharge of their several duties.

The results of the alignment which have been before mentioned will naturally receive notice as being of greater recognized consequence, but I think it desirable to mention also other cognate matters of engineering detail which will be of interest to all who care to give their attention to the subject.

The preliminary determination of length was first made by a measurement from end to end of the Tunnel, carried over the summits of the mountain.

The ultimate establishment of actual length, made by measurement through the Tunnel, completed since the entire way was opened in November last, have been found to differ from the preceding only by the amount of  $\frac{8.5}{100}$  of a foot, being in the proportion of only three one-thousandths of one per cent. of variation in the distance of  $4\frac{3}{4}$  miles.

Preliminary levels were carried respectively from east and west end over the respective summits, to determine the elevation at the central shaft.

Since the opening through the Tunnel has given opportunity of connecting the working levels, it is found that their determination of the exact elevation of the west portal varies



only by  $\frac{2\frac{3}{4}}{100}$  of a foot from the result of the preliminary levels.

This statement of closely concurrent results in the different instances, arrived at in each by separate processes necessarily so difficult and widely variant, will sufficiently indicate to all who may be familiar with the conditions which were involved, the great carefulness and precision which have been observed.

*Stone Arch and Façade at the West End of the Tunnel.*

Beside the 25,031 feet length of actual Tunnel excavation before made or therein provided for, the contract includes also the extending of the Tunnel for about 50 feet westerly from the west end of the brick arch already built, the additional distance to be covered by a stone arch terminated by a suitable construction of granite for the western façade. The excavation of the ground on which the above should be placed was commenced in the latter part of 1872, but suspended in March following, in view of the evident danger of undermining and causing a break in the channel of Tunnel Brook.

In the autumn, after the diversion of the brook into a new channel had been effected, the excavation was resumed, and the portion necessary for the stone arch was sufficiently completed to admit of putting in part of the concrete foundations before the close of the year.

The completion of the whole work of arch and façade will be readily accomplished before the end of the approaching summer.

*Railroad between the West End of Hoosac Tunnel and North Adams.*

Messrs McClallan, Son & Walker, contractors for the graduation and masonry, have been at some points of their work considerably delayed, but will probably be able to complete their contract before the line will be required for use.

They have during the past year built the abutments of two bridges, thus, with previous work, completing nearly all the masonry yet assigned to them.

During the early part of the autumn, they provided a steam-dredge for the excavation of the Hoosick River Canal, and

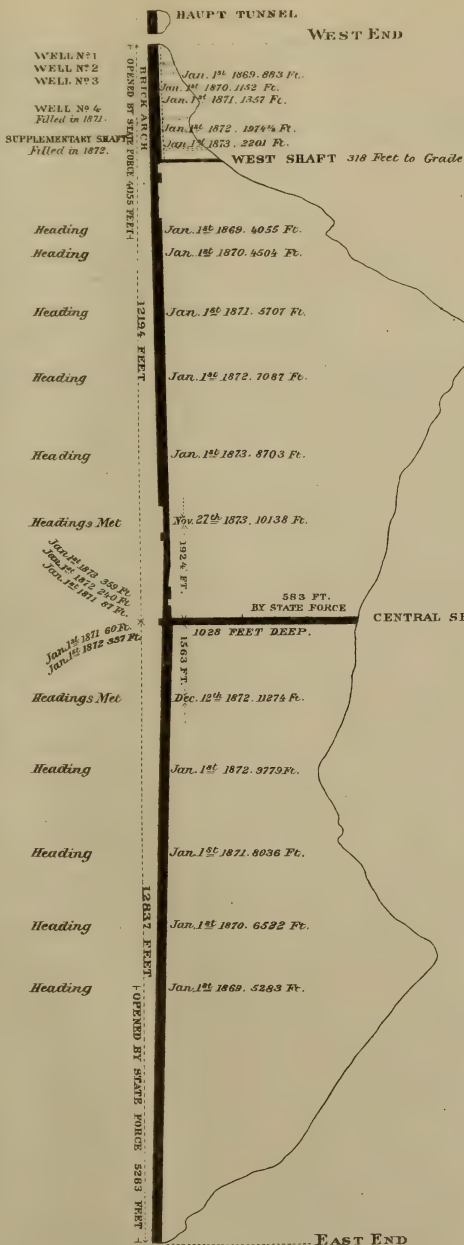
prosecuted that work until the appearance of extreme cold weather made its further continuance inadvisable.

The cut approaching the west portal of the Tunnel must be regarded as the most difficult portion of their contract. It has been worked during the past year with such commendable energy as to remove all apprehensions as to its timely completion.

Very respectfully,

Your obedient servant,

BENJ'N D. FROST.



F. S. PAUBRIC,  
Consulting Engineer.

BENJ. D. HIGST,  
Chief Engineer.

# PROFILE OF THE HOOSAC MOUNTAIN SHOWING THE TUNNEL FULLY OPENED. UP TO JAN. 1<sup>st</sup> 1874.





No 12

HOUSE.....

.....No. 9.

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BOSTON, HOOSAC TUNNEL AND WESTERN  
RAILROAD COMPANY.

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REPORT OF THE CORPORATORS,

APPOINTED UNDER ACTS OF 1874, CHAPTER 403.

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JANUARY, 1875.

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BOSTON:  
WRIGHT & POTTER, STATE PRINTERS,  
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1875.



## Commonwealth of Massachusetts.

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The Corporators of the Boston, Hoosac Tunnel & Western Railroad Company, in compliance with the provisions of the Act under which they were appointed (Acts 1874, ch. 403), respectfully submit the following

### R E P O R T :

Four members of the corporation had been appointed and qualified on the 29th of July, 1874, upon which day an organization was effected by the choice of William B. Washburn as President and of Stephen M. Crosby as Secretary of the company. To facilitate the despatch of business and to carry on more thoroughly the investigations ordered by the Legislature in the act of incorporation, two committees were at once appointed, one upon Contracts and Construction, consisting of Messrs. Washburn and Chadbourne; and the other, consisting of Messrs. Adams and Crosby, on Law Questions and Railroad Connections. Subsequently, to complete the number provided for by law, a fifth corporator was appointed, who gave to each of the two regular committees assistance in their work as frequently as occasion demanded.

### CONDITION OF THE PROPERTY.

On the 6th and 7th of August the Corporators made an examination of all the property committed to their care. The Troy & Greenfield railroad from the Tunnel to Greenfield, operated under lease by the Fitchburg R. R. Co. as lessors of the Vermont & Massachusetts railroad, was found to be in an exceedingly unsatisfactory condition, which was due not only to defects in its original construction but to subsequent and continued neglect in the work of repairs,—the

ties were decayed, the ditches filled up, and the iron worn out. Large claims were immediately made on the corporation by the lessees for aid, in addition to that provided for by the last Legislature (Resolves 1874, Chap. 67), to put the track in condition for trains to continue running upon it with safety during the autumn and winter. It was consequently evident that the road must at once be reconstructed or that extensive and costly repairs must immediately be made, a large proportion of which would prove a total loss to the State wherever a change of location might thereafter be decided upon. It was, therefore, deemed advisable to begin the work of reconstruction at once, and measures were immediately taken to secure the men and material necessary for a vigorous prosecution of the work. Mr. W. P. Granger was selected as chief engineer in charge of the operations, with Mr. Edwin Stratton as assistant engineer in the work of relocation. They were instructed to at once proceed with the preliminary surveys necessary to determine what changes in the line were desirable or feasible, so that the work might be put under contract and prosecuted as far as possible during the autumn.

#### RELOCATION.

To determine what alterations and improvements it was desirable for the State to make at this time,—how much of the old road was worth saving and how much was worthless,—was no easy task. Engineers and railroad experts had differed widely on this subject in the past, and they could not be expected to agree fully now. The Corporators, therefore, judged it advisable to select a consulting engineer, who had had wide experience in the location and construction of railroads, and to submit to him in a great measure the final settlement of the many difficult questions which were sure to arise. After careful inquiry and consideration, they secured the services of Mr. Thomas Doane, and he has been called upon to aid in settling all difficulties that have presented themselves to the mind of the resident engineer. His report in appendix C is referred to for a detailed account of the progress and present condition of the work.

After a careful examination of the possible changes, with



due consideration of former surveys, it was judged best not to alter essentially the present location of the road, but to reduce curvature, where practicable so to do, and to make such other changes as would render the line first class when the work of construction was completed.

#### TRACK.

In the construction of bridges and all mason-work provision has been made for a double track, although a single track, of such thorough construction and of so easy a grade as has been arranged for, may be sufficient for some years to come; certainly until the western connections are secured and have had time to develop their importance. The additional work required for a second track can be done when such a track is called for, to better advantage than at present.

#### CONSTRUCTION WORK.

The changes to be made in the line between the Tunnel and Charlemont were substantially determined upon early in September, and the work was put under contract on the 15th of that month. The specifications required all bids to be made, both for earth-work and rock-work, per cubic yard. Of the five bids for this section that of N. C. Munson was the lowest, and he received the contract. This section was intended to be completed by the 1st of December, 1874, but, although now well under way, it cannot be completed before spring. On the 25th of September another contract was made for the remaining part of the road from Charlemont to Bardwell's Ferry, in two sections. The first section, from Charlemont to Shelburne Falls, was awarded to N. C. Munson, and the second section, from Shelburne Falls to Bardwell's Ferry, to B. N. Farren. The contracts for this work were made in the same manner as that for the first. Each section is to be completed by the 1st of July, 1875, and the work has been progressing in a satisfactory manner. As it was all contracted for by the cubic yard, at a specific price for each kind of work, wherever done, the Corporators were left free to change the location of the road as in the judgment of the engineers should seem best.

To secure the best and most durable track, especially on a road of so much curvature, it was apparent that steel rails would not only be the best, but by far the cheapest, as they could be purchased at a discount of about forty per cent. on their former price. A contract was accordingly made with the Pennsylvania Steel Company, for 1,100 tons of their best hammered steel rails, with the fish-joints and stops all complete. The rail weighs sixty pounds to the yard, and cost \$85 per ton.

Where new bridges were needed, those of iron have been provided for; where the old ones would answer, they have been strengthened and made better than when first built.

#### ROAD WEST OF TUNNEL.

The road between the west portal of the Tunnel and North Adams was far from being completed, at the time of our appointment. Of the three bridges that were to have been completed by the 1st of August, not one was on the ground at the date of our first visit, August 7th. As this work was all under contract by action of the Governor and Council, we could only indirectly hasten its completion. We were able to begin to lay the track, Nov. 19th, and the last bridge was not yet in place at the time of the preparation of this report.

#### ROAD WEST OF ADAMS.

That part of the road between North Adams and the Vermont line is still under the control of the Troy & Boston Railroad Co., and will be kept in running order by them until their lease expires. No work has been done upon it, but an examination has been made by the consulting engineer, and his report may be found in appendix C.

#### WORK EAST OF BARDWELL'S FERRY.

Although the work of construction authorized by chapter 402 of the acts of the last Legislature was confined to that part of the road west of Bardwell's Ferry, it was judged desirable that a survey should be made of the entire line. Mr. Stratton was therefore directed to make such survey under the following instructions :

"You are to be employed as engineer-in-chief, to make surveys of the Troy and Greenfield railroad east of Bardwell's Ferry, to determine the following points, viz :

"1. What changes are desirable if the present route is to be continued as the permanent through route.

"2. What changes can be made to have the through route pass through Greenfield.

"3. What is the best possible location for a through route for said road, east of Bardwell's Ferry, *the shortest route* and *the best grade, without any reference to local traffic.*"

In the prosecution of this work, he was authorized to procure all needed assistance, and for the results of his examinations and surveys reference is made to Mr. Doane's report in appendix D.

#### TUNNEL.

Under the construction given by the Attorney-General to the several acts of the last Legislature (appendix E), the appropriation for the completion of the Tunnel and for arching the same where necessary, was at the disposal of the Governor and Council, under whose direction the work was to be done, so that we, as Corporators, have had nothing to do with any contracts or work connected with the Tunnel, excepting to approve, at the request of the Governor and Council, the contract for arching made by them, and to appoint experts to examine and report upon the amount of arching necessary, as required by section 5 of the act (1874, chapter 403) under which the corporation was formed. That act is specific in defining the duties of the experts and in fixing the time for the examination. The experts selected as geologists were Professor T. Sterry Hunt, of Boston, and Professor James Hall, of Albany, N. Y. ; as civil engineers, Thomas Doane, of Charlestown, Josiah Brown, of Fall River, and Daniel L. Harris, of Springfield.

The reports of these gentlemen are very full and will give a large amount of valuable information in regard to the present condition of the Tunnel, the amount of arching which will be required to render it safe for use, and the changes that may be expected through the action of agencies that are likely to continue in operation. It is a matter of regret that the



work was so far from being completed when the examinations were made. Until the Tunnel is properly trimmed, there must be uncertainty as to the real condition of the rock. This unfinished condition of the Tunnel will explain, in part, the difference in the reports as to the amount of arching required, though the examination was delayed to the latest day possible, under the requirements of the law. For the reports of the experts, reference is made to appendix A. A tabulated statement has been made and printed with the reports, showing at a glance how much of the Tunnel is considered perfectly safe by all the examiners, how much all agree must be arched, and how much a majority agree should be arched.

In the same appendix will be found the report of E. S. Philbrick to the Governor and Council. Mr. Philbrick's intimate acquaintance with the Tunnel makes his report exceedingly valuable as a basis of comparison for these reports of the experts, who made their examinations separately, and, most of them, without any previous knowledge of the nature of the walls or condition of the work.

A final settlement under the contract for excavating the Tunnel was effected with the contractors by the Governor and Council on the 22d of December, and it was thereupon transferred to our control, subject to the contract for arching made with B. N. Farren shortly previous. The time required to complete this arching is estimated at from six to eight months; but provision is made in the contract for the daily running of two trains each way through the Tunnel while the work is going on, if found to be desirable. A single, iron-rail track will at once be laid through the Tunnel, and will be used by the contractors in doing the work of arching; trains will also be run over it, should it be deemed expedient to put them on.

#### FITCHBURG RAILROAD COMPANY.

It has already been stated that immediately after our appointment claims for aid in making repairs on the Troy & Greenfield road were made by the Fitchburg Railroad Co. These claims, we, as Corporators, did not feel authorized to allow, according to our interpretation of the lease under which that company holds the road. But, as something had to be



done to keep the road in running order, it was agreed by both parties to leave the interpretation of the lease to William G. Russell, Esq., as referee. Both parties introduced witnesses, and made a full presentation of the case. The decision of the referee was, that the sleepers and iron put into the track between Greenfield and the Tunnel since July 1, 1874, and all sleepers and iron hereafter needed to render the road safe for operation, and the expense of placing the same, should be paid for by the State. Any unexpended balance of the fifteen thousand dollars appropriated by the last Legislature, which had not been expended in necessary repairs previous to July 1, was to be credited to the State as part payment for iron and sleepers used since that time. All other repairs are to be made by the Fitchburg Railroad Co. at its own expense.

#### OTHER MATTERS OF INVESTIGATION.

The Corporators were further directed to furnish full and specific information to the Legislature on various points enumerated in detail in the second section of the act under which they were appointed. They were, also, by the fourth clause of that section, generally directed to give at this time such information, and to offer such suggestions and recommendations in regard to the management, development or disposition to be made of the railroad and Tunnel as they might deem expedient and for the interest of the Commonwealth. In presenting this part of the report, therefore, it will be most convenient to follow the line of investigation which has been pursued during the past summer; and, in doing this, it will be found that each of the several specific points upon which information has been called for will present itself for consideration in the proper place.

It does not seem expedient in the present report to enter into any disquisitions as to the peculiar geographical situation of New England or Massachusetts, as compared with other portions of the country, or as to the nature and industries of its people. These have certainly been sufficiently dilated upon heretofore, and it is now only necessary to maturely consider the existing facts immediately and practically bearing on the questions with which we have been

called upon to deal. These questions relate wholly to the organization and development of a railroad undertaking; and before, therefore, attempting to pass upon them, it is necessary to have a very clear idea of what that undertaking may reasonably be expected to accomplish. If the Tunnel line is to be a mere duplicate Boston & Albany railroad, twenty miles farther north, running between the same termini and competing under a similar management for a share of the business supplied by the same feeders, in such case the questions of organization and management are greatly simplified. If, however, it is to become an agency towards the development of some new and larger system of transportation; if it is to introduce into the State more perfect facilities for carriage; if, in a word, it is ever to justify the enormous cost of its construction, then these questions of organization and development will probably be found far more intricate problems to deal with. The first investigation we had to enter upon related, therefore, to the new and especial uses to which the Tunnel line could be put now that it was practically completed. Was there any work of transportation for it to do which was not now done over the Boston & Albany road?—Was there any new element, or power, which it could introduce as a competing force, into the carrying business of New England?—These questions definitely settled, it would probably be found that subsequent details were almost in the nature of inevitable sequences from them.

#### WESTERN CONNECTIONS.

The Boston & Albany railroad forms a close connection at Albany with the western railroad system over the New York Central tracks. It is the most valuable outlet of the last-named company, and its relations with it are of the closest possible description. A rival line to the Boston & Albany, connecting with the Central road, might possibly enjoy equal and impartial advantages with it, but it could certainly expect no more; it would open no new channels of trade; it could introduce into New England no new elements of competition. Can, then, the Tunnel line, having at last reached the Hudson River, lead to any results which have not been brought about already?

A somewhat general survey of the channels of communication between the interior and the seaboard is necessary to any satisfactory solution of this question. Such a survey can, however, be made very brief. These channels of communication are of two descriptions—those by rail and those by water. Those by rail may best be considered first.

#### ALL-RAIL CONNECTIONS.

There are now four of these channels completed and in use, and yet others are in course of construction or projected. The completed lines are the New York Central, the Erie, the Pennsylvania, and the Baltimore & Ohio railroads. The projected lines are two in number: one following the south bank of the Mohawk River, and the other connecting Oswego, on Lake Ontario, with a point near the head-waters of the Hudson. One only of these several and competing lines is now brought into an all-rail connection with Massachusetts through the agency of the Boston & Albany road. The mission of the Tunnel should be to bring into the State as many of the others as possible; and the line operating through it should be organized and developed with that result kept steadily in view.

In order that the most definite possible information might be obtained as to what connections were feasible between the Tunnel line and these western routes, the Corporators placed themselves in direct personal communication with their leading officials, having interviews with Mr. Vanderbilt, President of the New York Central; with Mr. Ramsey, of the Albany & Susquehanna; with Mr. Dickson, of the Delaware & Hudson Canal Co.; with Mr. Jewett, of the Erie, who represented also in this connection the Baltimore & Ohio interest, and with Messrs. Scott and Cassatt, of the Pennsylvania railroad. It is believed that in this way we fully possessed ourselves of the views of each of these gentlemen and of the companies they represented.

#### THE NEW YORK CENTRAL.

From Mr. Vanderbilt, both directly and indirectly, assurances were received that no discrimination whatever should be made by the Central road, as between the Boston &



Albany and Tunnel routes, but that both should receive every facility for the interchange of business and be treated with absolute impartiality. Mr. Vanderbilt took the ground that the New York Central railroad was purely a carrier for hire,—that the object of those controlling it was to make money, and that to do this they sought business from any and every quarter,—that it was wholly immaterial to them whence business came or whither it went, so that it came and went; and that now the New York Central was so equipped that it could easily accommodate any amount of traffic which might offer. As to any discrimination between the Tunnel and the Boston & Albany lines, Mr. Vanderbilt stated that the New York Central at its western terminus connected with two independent and competing roads, the Michigan Southern and the Great Western of Canada; both of these were always treated with impartiality, and he saw no reason why a different policy should be adopted towards roads connecting at the east end of the line from what was adopted at the west end.

These assurances seemed to be satisfactory so far as they went. But, even if they were carried out both in the letter and spirit, they could secure to the people of Massachusetts nothing that they did not already have,—nothing new could be anticipated from this quarter.

#### THE DELAWARE & HUDSON CANAL COMPANY, AND PENNSYLVANIA RAILROAD.

An interview was next had with Messrs. Ramsey, Dickson and Scott, looking to a connection with the lines represented by them,—one of which reached into the coal-fields of Pennsylvania, while the other composed the great central route to the West. The Albany & Susquehanna railroad, of which Mr. Ramsey is President, runs in a south-westerly direction from Albany and Schenectady to Binghamton, at which latter point it connects with the Erie railway and with the system of the Delaware & Hudson Canal Co., by which last corporation it has been leased in perpetuity. A close connection between this road and the Tunnel line could now be formed either at Schenectady or at Albany, by means of which a new access could be gained, not only to an additional railroad system to the West, but also to



the coal-fields of Pennsylvania. Nor do the possible advantages of this connection stop here. Mr. Scott, President of the Pennsylvania Railroad Co., called the attention of the Board to the fact that a small link of only eighty miles of road, through a region rich in coal deposits and favorable to railroad construction, was alone required to effect a connection, over the Albany & Susquehanna, between the Tunnel line and the elaborate railroad system controlled by the Pennsylvania interest. The importance of such a connection cannot easily be overestimated,—it would at once throw into Massachusetts the great power and pervading influence of the Pennsylvania company as a competing force. When it is stated that this company now owns or controls 6,000 miles of track, leading to all points of the West, South, and Southwest, and representing \$400,000,000 of capital,—that it is supplied with a most perfect machinery for transportation in competition with all other routes, and that its affairs are managed with unsurpassed skill and energy, an estimate may be formed of the consequences likely to ensue from placing it side by side with the existing transportation agency of Massachusetts. A considerable amount of information, as to the character and amount of business which might be expected from this connection, was prepared for the use of the Board at the direction of the Pennsylvania Railroad Co., and will be found in appendix B of this report. Both Mr. Dickson and Mr. Scott, on behalf of their respective corporations, evinced the utmost interest in the development of this connection, and for very obvious reasons,—in both cases it gave to them at least as much as it received from them. If they could open to it a close and valuable connection with the coal-fields and the interior; it, on the other hand, opened to them the shortest and most profitable access to the more densely populated regions of New England. The control of that New England business has hitherto been the greatest advantage which the New York Central road has enjoyed in the contest with its southern rivals;—the travel to and from New York city has always been subject to sharp competition, while that to Massachusetts has been an almost exclusive property. On behalf of the Pennsylvania road, Mr. Scott made no concealment of the great anxiety he felt to secure an outlet to that

traffic, and expressed his readiness to enter into relations with the Tunnel line as close as those which exist between the Central road and the Boston & Albany, and to afford equally favorable rates between places in Massachusetts and all leading points at the South and West. An active railroad competition would thus be established, which, even if it does not permanently reduce rates, always produces an immediate influence on the manners of employés, and on the facility and despatch with which the work of transportation is effected. So far as the Delaware & Hudson Canal Co. is concerned, the mutual advantages and importance of this connection do not need to be enlarged upon,—they immediately suggest themselves. Not only would it open to that company an extended market for its coal, but it would convert the Albany & Susquehanna road, leased by it, from a local into a through line.

#### THE ERIE RAILWAY.

This, however, is but a portion of the large field which may be opened to the Tunnel line through this south-western connection, for at Binghamton the Erie railway also is reached. The Erie direction, as represented by Mr. Jewett, the President of the line, was found to be no less awake than Messrs. Dickson and Scott to the importance of the proposed connection. Here, too, assurances were given of arrangements for through business in no respect inferior to those existing between the Boston & Albany and the New York Central, which should go into effect as soon as the Tunnel was in condition to coöperate in them. Neither in this case, nor in that of the Delaware & Hudson Canal Co., was any delay called for to allow time for development; everything—roads, connections, rolling-stock, agencies and business—was ready, and the only difficulty lay at this end of the line. In the case of the Erie not a single link of the chain was wanting, and this fact was closely connected with the development of the Baltimore & Ohio combination. The recent completion of the air-line extension of that road to Chicago, makes practicable a new and close all-rail connection between that city and the seaboard. So far as all New York and eastern business is concerned, this extension is to be operated in

connection with the Erie road, thus bringing it into communication with the Tunnel line.

### RELATIVE LENGTH OF ROUTES.

As respects distance, an examination of the very elaborate tables in appendix B of the present report, will show that there is no material difference to all principal western points between the Boston & Albany in connection with the New York Central, and the Tunnel route in connection with the Albany & Susquehanna road.\* On a front westward from Boston, extending from Chicago at the north to Pittsburg at the south-west, and including St. Louis, Louisville and Cincinnati, this difference would vary from 16 per cent. in favor of the newer route, to 22 per cent. in

\* The following table will show at a glance the comparative distances of the principal railroad points of the West from Boston by the New York Central and by the Albany and Susquehanna roads. The distance by way of the Boston & Albany and the New York Central is taken as the unit of comparison, and is given in the first column; that by way of the Erie railway and its connections, in the second column; that by way of the Northern Central, Philadelphia & Erie, Bald Eagle Valley & Pennsylvania roads, in the third column; that by way of the Northern Central and Philadelphia & Erie, in the fourth column; and that by way of the Northern Central, the Philadelphia & Erie, and the Low Grade Division of the Allegheny Valley roads in the fifth column. The last three routes are under the control of the Pennsylvania Railroad Co., and require the construction of some eighty miles of road by it, or by the Delaware & Hudson Canal Co., to complete the connection.

*Comparative Table of Distances from Boston.*

DESTINATION.	BOSTON & ALBANY.		BOSTON, HOOSAC TUNNEL & WESTERN.							
	Distance via N. Y. Cent. R. R. and connecting lines.	Percentage.	Distance via Erie Railway and connecting lines.	Percentage.	Distance via Northern Cent., P. & E., B. & E. V. and P. Railroads and connecting lines.	Percentage.	Distance via Northern Central and Phil. & Erie Railroads and connecting lines.	Percentage.	Distance via Northern Cent., P. & E., L. G. Div. A. V. R. R. and connecting lines.	Percentage.
	Miles.		Miles.		Miles.		Miles.		Miles.	
Buffalo, . . .	499	100	542	108	-	-	650	130	-	-
Erie, . . .	527	100	630	107	-	-	679	116	-	-
Pittsburg, . . .	767	100	766	100	641	84	-	-	685	89
Cleveland, . . .	682	100	720	106	791	116	774	113	835	122
Toledo, . . .	795	100	833	105	902	114	887	112	946	119
Chicago, . . .	1,019	100	1,075	106	1,110	109	1,131	111	1,154	113
Columbus, . . .	820	100	858	105	834	102	912	111	873	107
Cincinnati, . . .	926	100	979	106	954	103	1,018	110	998	108
Louisville, . . .	1,036	100	1,089	105	1,064	103	1,128	109	1,108	107
Indianapolis, . . .	964	100	1,018	106	1,022	106	1,056	110	1,066	111
St. Louis, . . .	1,226	100	1,264	103	1,261	103	1,295	106	1,305	106



favor of the older, and would generally be from 3 to 5 per cent. only, to the leading railway centres of the West, in favor of the latter. Where such great distances are traversed, so small a percentage of differences between rival lines, especially in the carriage of freight, is found to be practically immaterial, and is, indeed, less than the difference (about 7 per cent.) which now exists between New York and Chicago by the three great competing lines—the Michigan Central, the Michigan Southern, and the Fort Wayne.

#### RELATIVE GRADIENTS OF ROUTES.

As respects grades, the two routes, each considered as a whole, do not greatly differ,—the New York Central portion of the one possessing decided advantages over the Albany & Susquehanna section of the other, which again is in a great degree counterbalanced by the similar advantages of the Tunnel section in Massachusetts over the Boston & Albany. On the 340 miles from Binghamton to Boston, the total rise and fall is 3,688 feet on the Tunnel and Susquehanna route, as compared with 3,154 feet for an equal distance on the Albany and New York Central.\* Under the *pro rata* system of carrying freights, however, the burden of unfavorable grades falls wholly upon the company which has to surmount them, and not upon the members generally of the combined line. In this case it would fall on the Albany & Susquehanna road,

\* *Boston, Hoosac Tunnel and Western Route.*

	Ascent East-ward.	Ascent West-ward.
Boston—Tunnel Summit, . . . . .	1,521	2,339
Tunnel Summit—Schenectady, . . . . .	782	180
Boston—Schenectady, . . . . .	2,303	2,519
Schenectady—Binghamton, . . . . .	1,385	1,951
Boston—Binghamton, . . . . .	3,688	4,470

#### *Boston and Albany.*

Boston—Albany, . . . . .	2,850	2,865
Albany, Westward 134 miles, . . . . .	304	692
	3,154	3,557



and would be compensated for in very great degree in a reduced expense for power; its coal costing that company but \$1.50 per ton, as compared with \$4.00, its cost to the New York Central. So far as the Tunnel line itself, as an integral part of a through route, is concerned, it would have to contend with but 2,303 feet of adverse grade between Schenectady and Boston, as compared with 2,850 feet between Albany and the same point over the Boston & Albany.

Here, then, if it be but properly and promptly developed, and without need to go further, is an ample field through which the construction of the Tunnel may be justified. The projected lines and the facilities for water communication are yet, however, to be considered.

#### PROJECTED ALL-RAIL LINES.

The two most noticeable projected lines are those running, the one from some point near the head-waters of the Hudson to the port of Oswego on Lake Ontario; the other, from Albany west, along the south bank of the Mohawk, and parallel to the New York Central on its north bank. By means of the first of these two routes the Tunnel line, it is hoped, will reach the internal navigation of the great lakes in the first place, and can subsequently connect with the through railroad line already partially completed along the south shore of Lake Ontario. A great deal of information in regard to this route to Oswego will be found in the report of Mr. Morison, in appendix B, but the Board has not found it necessary to pass definitely upon its merits and advantages at this stage of the investigation. The road is, at best, one in the future, which must be further developed by those directly interested in it before it can practically be dealt with in connection with the Tunnel route. At present it needs to be regarded only as a possible element in future growth, a way to a connection with which should always be kept open. This scheme has, therefore, a very important bearing on the location of the Tunnel route from North Adams to a terminus in the State of New York, though not in itself sufficiently matured to call for immediate consideration. The same is true of the road on the south side of the Mohawk; it as yet exists only on paper, and, though those

in charge of the Tunnel line should so shape its course that it may always be in a situation to avail itself of any new opening which may hereafter offer, it would be in the last degree reckless for them in any way to now involve the enterprise intrusted to their charge in the affairs of these inchoate companies. Such a proceeding would also seem to be wholly unnecessary in so far as the great question of securing access to the commerce of the lakes is concerned.

#### EASTERN TERMINUS OF LAKE NAVIGATION.

The eastern terminus of that navigation, so far as the Tunnel is concerned, would seem to be at Schenectady, rather than at Oswego. Schenectady, though 17 miles west of Albany, is but two miles further from Boston by the Tunnel route than Albany is by the Boston & Albany; in other words, to Schenectady, as a common point going west from Boston, the Tunnel line gains 15 miles over the Boston & Albany. Schenectady has the further advantage of being situated upon the Erie canal, immediately above the heavy lockage by which that canal descends along the falls of the Mohawk to the Hudson, above Albany. The canal navigation from Oswego to Schenectady is consequently of the most favorable description, presenting but 45 locks in a distance of 176 miles. The railroad to Oswego would be built more especially for the carriage of produce from the lakes to the seaboard. This same produce can now be carried by canal from Oswego to Schenectady, and there elevated from the barge into cars at a cost of \$1.50 per ton. As the distance from Oswego to Ballston by either of the proposed routes is not less than 153 miles, the sum above named would allow a charge of but one cent per ton per mile upon them, at which rate it does not seem probable that, on a business open but half the year and unsustained by any considerable local traffic, they could compete. It is, therefore, not easy to see what advantage, so far as the transportation of western produce into New England is concerned, would be gained by placing the railroad terminus at Oswego instead of at Schenectady. Without undertaking, however, to finally pass upon this question, it is at least apparent that, while awaiting the development of the Lake Ontario enterprises, the Tunnel

route can reach a terminus of lake navigation sufficient for every immediate purpose at a point which is already accessible to it. More detailed information on these points will be found in the report of Mr. Morison, in appendix B.

#### THE FIELD FOR DEVELOPMENT OPEN TO THE TUNNEL LINE.

From this general survey it would, therefore, appear that the field open for development in the interests of the people of Massachusetts through the Tunnel line, as distinct from that hitherto developed by the Boston & Albany, is of the most ample description. Leaving the New York Central wholly out of the question,—treating it as if it did not exist,—the connections ready for immediate use include both land and water routes stretching to every part of the interior and capable of placing the Tunnel line at once, so far as through business is concerned, on a footing in no respect inferior to that of the Boston & Albany. Through the agency of the Tunnel route, if properly and energetically managed, eight or ten thousand miles of track and hundreds of millions of additional capital may be brought to bear as a competing force to do the transportation of Massachusetts. No construction of long or expensive new lines is called for,—no loans of credit to aid in the building of projected roads of dubious value is required to secure this important result; it is only necessary to take advantage of facilities which already exist and which invite participation.

#### WESTERN TERMINUS OF TUNNEL LINE.

If these premises are sound, certain conclusions will be found to result from them which render it no less unnecessary than inexpedient for the members of this Board to now undertake to pass upon the relative merits of the several points suggested as being best adapted for the terminus of the Tunnel line in New York, or as to the best route by which such point could be reached. As such terminus, Troy, Albany and Schenectady each have earnest advocates, prepared to show that every possible merit is concentrated in the particular locality favored by them, and in their especial route to reach it. The investigations which have been made are sufficient to induce us to conclude, that, when this question



presents itself at the proper time, its decision by those who may then have the interests of the line in charge will be found very simple; that it will, in fact, be practically dictated by circumstances over which they will have very little control. At present it is sufficient to say that two routes to Albany as the terminal point have been pressed upon our consideration,—that one route already exists to Troy, and that another is projected to Schenectady. There is, therefore, no probability that the Tunnel line will lack western outlets, or that those controlling any of these outlets will prove unwilling to negotiate in respect to their use. For us to undertake at this time publicly to decide upon their merits would merely provoke a bitter and wholly useless struggle before the Legislature, which could not but endanger the passage of any measure of practical utility, and greatly embarrass those negotiations which must hereafter inevitably be entered upon. An easy access to Albany, to Troy or to Schenectady, as hereafter may be desired, is perfectly feasible at reasonable cost; to further discuss the subject now would inevitably complicate rather than simplify matters.

#### ORGANIZATION OF THE TUNNEL LINE.

With this ample field for usefulness before it, the question next presents itself,—How can the Tunnel line be organized so as to secure the greatest results from it? On this point, as the result of our investigations, the members of the Board, regardless of all former individual predilections, have found themselves compelled to very definite conclusions, as a unit. It will be noticed that the inevitable connections of this line—the connections through which alone, for years to come, it can hope to be of any real service to the people of the State—must be with large consolidated interests, doing an enormous business under vigorous and concentrated managements. It will also be noticed that it is the destiny of the Tunnel route to live in active competition with a rival route immediately south of it, and that this rival route is in the hands of a firmly consolidated corporation of large means, which carries on an enormous business by means of a very perfect equipment, controlled by a vigorous and experienced management. To justify the construction of the Tunnel, it is



necessary that a very extensive traffic should be carried on through it at very low rates. Here, then, are three conditions to success,—a vigorous and powerful connection, a formidable and incessant competition, and a heavy individual traffic. Now, if there is one principle more clearly established than any other, as a result of all railroad experience, it is that disconnected corporations, under a loose or feeble management, and with insufficient capital and equipment, can neither deal successfully with connecting, nor struggle successfully against competing, roads. So, also, as regards railroad business, it is only when it is done on the most extensive scale that it can be done on the most favorable terms; that it may be done economically, the volume of business must be the largest possible, and the machinery for handling it the most perfect possible. These principles are very elementary, but they are apparently conclusive as to the matter under discussion; for we hold it almost puerile to hope that the Tunnel route can be developed in any such way as to justify its construction except through the agency of an energetic, concentrated and wealthy management. In organizing such a management, it may be desirable to secure every guarantee of the use of the Tunnel by weaker connecting roads; but it is none the less true that the business of the main through line can only be developed—as the people of the State have a right to expect it should be developed—through a management as vigorous as those with which it is forced either to contract or to contend. A large business cannot be done by a small or poor company.

#### PROPOSED METHODS OF ORGANIZATION.

Four methods of organization have been suggested. These are,—first, the simple possession of the Tunnel and some portions of the connecting roads by the State, with a view to holding it in trust, charging simply a moderate toll for its use; this being the plan known as the “Toll-Gate Plan.”

#### THE “TOLL-GATE” PLAN.

We do not consider it necessary to discuss this scheme in detail. It is perfectly feasible for the State to hold the Tunnel in this way; but we are wholly unable to see what public

good would be subserved thereby, unless the State also held the road on each side of the Tunnel to the point at which it is intersected by the most remote connecting road. For instance, it is not easy to see how the fact of the Commonwealth owning the Tunnel could protect or benefit the Boston, Barre & Gardner, or the Boston, Clinton & Fitchburg roads in the use of the Tunnel, unless the Commonwealth controlled the road east and west of that locality to the points where these roads intersected with the through line, and to the points on the other side where they proposed to leave it. This proposition, also, is based upon what we cannot but regard—for the reasons which have already been given—as the mistaken assumption that disconnected companies of small capital, and necessarily feeble management, can effectively develop the traffic of great through lines.

#### ORDINARY CORPORATE MANAGEMENT.

The sale of the Tunnel to a private organization has also been suggested as a solution of the difficulty, and provision for it was at one time made by law. As the Legislature, in framing the act creating this corporation, especially struck out of the bill a provision directing inquiry to be made on this point, it is unnecessary to further discuss it. As only through its sale could the Tunnel be placed under private management, this exclusion of the proposal of sale involves also the exclusion of a recourse to ordinary corporate management.

#### EXCLUSIVE STATE OWNERSHIP.

Under these circumstances, the only other forms of management which can be suggested are state-ownership, pure and simple, on the one side, and, on the other, a system of mixed ownership, in which the property of the State would be consolidated with that of those owning the other links which go to make up the through line. From our present point of view, the project of exclusive state-ownership ceases to be a theoretical question and becomes a purely practical one. Looking upon it simply as such,—carefully excluding from its consideration all differences of opinion as to its economical, social and political bearings,—we have been unable to arrive at a divided conclusion. Such a solution of the difficulty is

practically out of the question, and, at this time, not to be thought of. The financial issue alone would seem to present an insuperable obstacle, for it is highly improbable that the people of the State would consent to even the lowest expenditure which it would necessarily involve. How much this would amount to cannot now be definitely stated; the sum could not, however, but be very large, involving, as it must, in the first place, the purchase, at the outside price, of the connecting roads necessary to complete the through line; and, secondly, their development and equipment when purchased. For if the people of the Commonwealth for a moment imagine that, having now driven a tunnel through the Hoosac Mountain, and, having thus secured an unbroken line of rails from Boston through to the West,—if they imagine that, having secured this result, they have a through line, equal to the doing of a first-class business, they are laboring under a most unfortunate misapprehension, of which it would be well to at once disabuse them. Very large sums, the amount of which cannot now be readily estimated, are yet to be expended before the line from Boston to North Adams, or even to Greenfield, can be made ready to do any considerable traffic, or to do it with any economy. To compete over this line, in its present condition, with the Boston & Albany road would be simply out of the question. Through considerable distances it is now, at best, but a second-class single-track road, with an insufficient equipment, without proper terminal facilities, and clad only with iron. It is probably, therefore, no overestimate to say that, at this time, were the rails connected through from Boston to Troy, many millions of additional outlay would yet be required to place the whole road in any condition to do a large business economically; while the mere attempt to do such a business under existing circumstances, were such an attempt feasible, would, in less than six months, utterly demolish considerable sections of the line. If these facts are once fully understood, it is not probable that, in the present divided state of public opinion on the subject of the state-ownership of railroads, the people of Massachusetts would, in addition to the \$14,000,000 the Tunnel has already cost, authorize an additional outlay of some \$20,000,000 in round numbers more for the purchase



and development of the roads connected with it. As a practical legislative measure, therefore, the complete ownership by the State of the entire line seems to us to be beyond the range of discussion. Not only would it involve an unknown expenditure of public money,—for which we do not believe that either the Legislature or the people are prepared, and which certainly none of us are prepared to advocate,—but it is also wholly inconsistent with that early separation of the finances of the Tunnel railroad from those of the State, which we believe to be dictated by every consideration of prudence.

### MIXED OWNERSHIP AND MANAGEMENT.

If no one of the three methods of organizing an effective management, which have now been considered, is admissible, there only remains the one other,—that resulting from a mixed ownership,—to which we are necessarily brought. Under this system, the properties of the State would be consolidated with those of the private companies, and the whole would be managed by a board of directors representing the two constituencies. This seems to be the only practical solution of the difficulties which now impede the development of the Tunnel route, and the effecting of an organization of the nature referred to is apparently the essential step now to be considered.

### LEGAL RIGHTS OF COMMONWEALTH.

The act (1874, chapter 403) under which the present corporation was organized, directed it to submit full and specific information to the present Legislature on various points relating to the rights of the Commonwealth touching the several corporations owning the roads by means of which a through line to the West, by way of the Tunnel, might be organized. The information called for related to three different matters: first, to the voluntary consolidations which the corporations owning the properties might be disposed to favor; second, to the power of the State to take possession of the properties of these corporations, under the reserved right known as the 10 per cent. purchase clause; and, third, as to the purport and binding force of any traffic contracts which may have been entered into between



the State and any corporation or corporations owning or controlling railroads having connections with the Tunnel. So far as the information thus called for involves legal considerations, we would respectfully refer to a statement and opinion of James C. Davis, Esq., printed in appendix F, to this report; which opinion has also been examined and revised by Hon. E. R. Hoar. To that document we do not deem it necessary to add any suggestions of our own. The practical, as distinguished from the legal aspect of the question, is of more consequence, and to that we propose to address ourselves.

#### THE END TO BE KEPT IN VIEW.

Unless our investigations have resulted in wholly erroneous conclusions, the practical end to be kept in view is, as we have already stated, the organization, under one vigorous management, of a through railroad line between eastern Massachusetts and the interior of the continent. In effecting this, also, the State should be involved in the least possible future outlay, and the earliest practicable separation between its finances and those of the corporation should be effected. These results can be brought about in either of two ways: the corporations may voluntarily consent to the necessary consolidation of interests, merging themselves in it, or they can part with their properties, as the result of either compulsion or negotiation, and the State can then dispose of a proportional interest in the consolidated lines to new associates, in this way relieving itself of an undue financial burden. Those holding the interest thus disposed of, would then constitute the element of private ownership in the new organization, in lieu of the original holders of the property.

#### THE ASSUMPTION OF CONNECTING ROADS BY THE STATE.

The right of the Commonwealth is unquestioned to assume any or all of the properties required to complete the desired through line, on replacing to the owners the capital originally paid in, together with an amount equal to ten per cent. per annum on such sum from the date of its investment, after deducting the dividends received upon it. This right, however, is of very doubtful value, as, in order to avail itself of

it, the Commonwealth would now have to pay, in the case of the Fitchburg road, \$192 each, for shares which are selling in the market at \$121; and, in the case of the Vermont & Massachusetts road, \$312 each, for shares which have in the market never touched their par value, and are now selling freely at \$85. There can, also, in view of the opinion upon that point of Judge Hoar (appendix F) be little doubt, that the Commonwealth would have a right to assume possession of the properties of these corporations under its right of eminent domain, subject to the payment of compensation therefor; but this proceeding, if resisted, would involve so much litigation, and would entail a financial liability so difficult to estimate in advance, that it is unlikely to be resorted to. In any event, recourse would naturally be had to either of these ways of effecting the desired consolidation, only after every effort through negotiation had failed. The first attempt, therefore, must necessarily be through negotiations. These must, apparently, be conducted with the representatives of either the Fitchburg or of the Massachusetts Central Railroad Companies, or with both,—for these two alone control routes which, in combination with the Troy & Greenfield road, could complete a through line,—leaving the portion of the route west of the Tunnel to be decided upon after the eastern division has assumed a definite shape.

#### NEGOTIATING WITH CONNECTING ROADS.

Acting under instructions (Acts 1874, chap. 403, § 2, clause 1) to ascertain what combinations or consolidations to include the corporations referred to could be effected, the Corporators had various interviews with the officials of those companies. So far as anything specific or particular was concerned, these interviews were necessarily very unsatisfactory. Neither party had any authority to conclude anything, and, until each could know what the other was prepared to offer or accept, neither could be expected to commit itself. The conversations were, therefore, simply confined to generalities. We are, however, able to state that the representatives of the corporations expressed the most perfect willingness to negotiate, on terms which impressed this Board as not unreasonable, for either the sale, the lease, or the consolidation of

their properties; they simply desired that some one should be authorized to negotiate with them. The only reservation intimated as likely to be insisted upon, related in the case of the Fitchburg road to a guarantee of a reasonable rate of dividend to the stockholders of the company; this conceded, the officials in question expressed a confident belief that the corporation would be found disposed to meet the Commonwealth with satisfactory terms.

### CONCLUSIONS.

In view of all these facts the members of this Board have arrived at certain very simple and definite conclusions as to the steps immediately to be taken in relation to the Tunnel route, and these conclusions they have embodied in a form of bill, which accompanies this report. To these conclusions they have, one and all, found themselves compelled by the logic of their investigations, regardless of preconceived theories. As regards the Tunnel line itself, the previous estimates we had formed of the extent of the work it might be made to do, and of the public advantages which, under a vigorous management, might be made to result from it, have been much increased as our work progressed. We are, however, at least equally impressed with the extreme necessity of some early action which shall fix a policy under which it may be developed. The line is now in a position of no little jeopardy, and subject to contingencies which may greatly hamper its future growth. As yet, however, no united through line exists, nor is it even clear that the Legislature proposes to authorize one; the act from which this Board derived such power as it has, by the provisions of its seventh section, indeed, especially forbade any action on its part of a permanent character. Under these circumstances, we feel it incumbent upon us to urge upon the Legislature a decisive course looking to the organization of such a through line as may secure to the people of the State a fair prospect of developing the capabilities of the route. To that end we offer a bill of the simplest possible description, which, while it involves no new appropriation of public money, presents for an early decision the single issue of a consolidated line under mixed ownership. No attempt is made to insert



in this measure multifarious and complicated provisions regulating points of detail in advance. We do not believe that it is practicable to thus decide these questions, or that it is desirable for the State, any more than for private individuals, to fetter and tie down its agents by public conditions, as they are about to enter upon a difficult negotiation. If the Commonwealth cannot trust its servants, it may rest assured it can never successfully take a part in the management of a railroad property. In that case, the Tunnel had best be sold at once, that it may have a chance of future usefulness in the hands of private corporations who have more confidence in their agents. It is very certain that the great mass of questions and issues can only be settled as they arise, and then by persons clothed with ample power to settle them, and responsible for the use of that power;—it is as wholly futile to try to regulate and tie up the details of a railroad enterprise in advance, as it would be to order the succession of events.

The bill we submit, therefore, looks only to the organization of a corporation, with an element of permanence in it, the first duty of which shall be to effect a consolidation of interests. This done, we believe that other questions must be left to be disposed of as they arise. The great Tunnel route is unlikely either to be completed in a day, or perfected by a single act of legislature. The details of this bill call for little explanation. Provision is made for a new selection of directors in place of the present corporators, for obvious reasons, and the terms during which these directors shall hold office are graduated with a view to securing permanence of management and cutting off in so far as possible the liability to any general change for political reasons. Two clauses only regulating details in any measure for consolidation which may result from the passage of this bill are inserted, both of which explain themselves; the one secures to the Commonwealth in any consolidated company a representation not less than that of all the private owners combined, and the other provides for the impartial use of the Tunnel line by all railroads connecting with it. These it is believed are cardinal points, demanded by public opinion, and which may properly be laid down in advance of any negotia-



tion. The bill further provides that no consolidation of interests shall take effect until its terms have been formally approved by the Governor and Council,—in other words, the Governor and Council are placed towards the State's directors in the same position in which the body of stockholders in the private corporation stand towards the ordinary board of directors. The Governor and Council were designated for this purpose, rather than the Legislature itself, for the very obvious reason that the Legislature is in session on an average much less than half of the year, and, upon questions affecting railroad interests, prompt action is usually advisable. Beyond this it is believed that no further explanation is requisite, either of the measure submitted, or of the reasons which led to its preparation. The reasons have been stated at length. The measure is based upon the simple, familiar principles, which have long and universally regulated all corporate action. A board of directors is authorized to take certain steps deemed essential to the success of the common enterprise, and the result of their action is subjected to the approval of those who, for that purpose, represent the owners of the property.

WM. B. WASHBURN,  
CHAS. F. ADAMS, JR.,  
P. A. CHADBOURNE,  
S. M. CROSBY,  
S. B. STEBBINS,

*Corporators.*

## AN ACT

IN RELATION TO THE BOSTON, HOOSAC TUNNEL AND WESTERN  
RAILROAD COMPANY.

*Be it enacted, &c., as follows:*

SECT. 1. The governor, with the consent of the council, shall, as soon as practicable after the passage of this act, appoint five persons to be directors of the Boston, Hoosac Tunnel and Western Railroad Company; and whenever three or more of the persons so appointed shall have been qualified, the commissions of the corporators appointed under chapter four hundred and three of the acts of the year one thousand eight hundred and seventy-four, shall be vacated. One of the persons so appointed shall hold his office for five years, one for four years, one for three years, one for two years, and one for one year from the first day of July next after the passage of this act; and before the first day of July in each year thereafter, one director shall be appointed for the term of five years. Upon the occurrence of any vacancy before the expiration of a term, an appointment shall be made for the residue of such term.

SECT. 2. The board of directors provided for in the preceding section shall be a body corporate and shall have all the powers and be subject to all the duties and liabilities of boards of directors of railroad corporations, under the laws which now are or hereafter may be in force, except in so far as the same may be inconsistent with the provisions of this act, or of future acts passed in amendment hereof; *provided*, that wherever, under the laws of this Commonwealth, any act of the board of directors of a railroad corporation has to be submitted to the body of stockholders thereof for their action, in every such case the acts of the directors of the Boston, Hoosac Tunnel and Western Railroad Company shall, before taking effect, be subject to the approval of the governor and council; and in case of any consolidation of properties, as hereinafter provided for, the acts of the board of directors of the consolidated corporation shall, in the cases above specified, be subject to the action of the body of its stockholders, and also of the governor and council.

SECT. 3. Immediately upon the organization of the board of directors, provided for in the first section of this act, all the rights

and property of the State in the Southern Vermont Railroad, in the Troy and Greenfield Railroad, and in the Hoosac Tunnel, shall be transferred into their charge; and they shall have full and exclusive authority over, and be accountable for, all unexpended moneys which have been appropriated for the construction or completion of said railroads and tunnel. The said board of directors shall thereupon replace all other authorities, and shall represent the Commonwealth in every transaction affecting said railroads and tunnel, or arising out of any agreements or contracts now in force relating to the same.

SECT. 4. The board of directors provided for in section one of this act shall, as soon as practicable after entering upon their duties, proceed to negotiate with the corporations owning or operating railroads forming parts of a through railroad line between a point or points in eastern Massachusetts and points in the eastern part of the State of New York, by way of the Hoosac Tunnel, with a view to the early consolidation of such roads under one management.

SECT. 5. The directors of the Boston, Hoosac Tunnel and Western Railroad Company are hereby authorized to consolidate and unite the franchises and properties by this act placed in their charge, with the franchises and properties of other corporations forming parts of a through line, as provided in the preceding section, or, if necessary, to lease the same if beyond the limits of the State, upon such terms as may be agreed upon, subject always to the ratification and approval of the governor and council, and also of the stockholders of any private corporation concerned, at a meeting called for the purpose; *provided*, that the name of such consolidated corporation shall be the Boston, Hoosac Tunnel and Western Railroad Company, and provided also, that its entire capital stock, and bonded and other indebtedness shall not at the time of consolidation exceed                    millions of dollars.

SECT. 6. The board of directors of any consolidated corporation organized under the provisions of this act, shall have all the powers and be subject to all the duties and liabilities of boards of directors of railroad corporations, and shall consist of eleven persons, of whom the directors appointed under the first section of this act shall be five, and five shall be chosen by the stockholders of such corporation, at a meeting to be held within thirty days after the final approval of the consolidation; and said last-mentioned five directors shall be chosen to hold office for similar terms and under the same conditions, so far as may be, as the directors appointed under the first section of this act. The ten person selected in the manner aforesaid, or a majority of them, shall forthwith proceed to elect a president of the corporation, who shall hold such office at the

pleasure of the board of directors, and shall be, *ex officio*, a member thereof; and should the person so chosen as president be at the time of such a choice a member of said board of directors, his acceptance of such office shall create a vacancy in said board, which shall thereupon be filled by appointment or election, as the case may be.

SECT. 7. In any consolidation which may be effected under this act, the right shall be forever secured to every railroad corporation, whose tracks connect with such consolidated line, to have persons or property coming to or going from such connecting road carried over the whole or any part of the consolidated line, on terms as favorable as the corporation operating said line carries its own passengers and freight of similar description; and, in case of an inability to agree as to what such terms are, the question may be decided on the petition of either party in the manner provided in sections one hundred and sixty-six and one hundred and sixty-seven of chapter three hundred and seventy-two of the acts of the year one thousand eight hundred and seventy-four.

SECT. 8. Section seven of chapter four hundred and three of the acts of the year one thousand eight hundred and seventy-four, and all other acts and parts of acts inconsistent herewith, are hereby repealed.

SECT. 9. This act shall take effect upon its passage.





SCALE OF STATUTE MILES 20 TO AN INCH.  
PREPARED BY G. & C. B. COLTON & CO. 172 WILLIAM STREET NEW YORK.

MAP  
Showing Railroad Routes  
FROM  
**BOSTON TO THE WEST**  
EXPLANATION  
Railroads now built Connecting with Hoosac Tunnel  
Boston & Albany Railroad  
New York Central Railroad Connections  
Delaware & Hudson Canal C&D & Erie Railway do  
Pennsylvania Railroad Connections  
Railroads forming part of new Line to the West  
Proposed Railroads



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[ A. ]

REPORTS OF EXPERTS.

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## REPORT OF JAMES HALL.

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ALBANY, October 10, 1874.

PRESIDENT P. A. CHADBOURNE:

DEAR SIR :—On the 24th day of September last, I received from you a communication, of which I have appended a copy. In accordance with your instructions, I proceeded, on the 28th day of September, to the Hoosac Tunnel, and reporting myself to B. D. Frost, Esquire, the State Engineer, I was furnished with the necessary assistance and means of exploring the Tunnel, and commenced the work.

The first point of inquiry in your instructions relates to "the kind of rock and dip of strata through the entire Tunnel."

At the western entrance, the rock is a micaceous gneiss, or coarse decaying mica-slate, resting against or upon grayish white-banded limestone, which appears in the cutting as we approach the portal. This micaceous slate, with the exception of some harder layers, is everywhere in a state of decay or decomposition; and the Tunnel, for the whole distance of 2,200 feet, is already arched with brick, to protect the sides and roof. It is, therefore, only possible to see the rock in the piles of materials brought out from the excavation at the west end; and from these, together with some slight exposures remaining, we learn that the rock consists of a coarse, distinctly laminated, micaceous gneiss, or coarse mica-schist, in a decomposing condition, and colored by iron. This rock alternates with stronger beds, and less distinctly laminated, and which have resisted decomposition both *in situ* and in the exposed mass brought out from the Tunnel. At a point some 1,200 or 1,400 feet from the west portal, a bed of coarse, im-

pure brown hematite was cut through in the progress of the work. This ore-bed is still visible, cropping out near the line of the road from the Tunnel to the west shaft, and has a thickness of from four to six feet.

From the termination of the arch to about 3,900 (4,000) feet, we have mica-schist and micaceous gneiss, with alternations of coarser and finer beds. Between 3,500 and 4,000 feet, a gradual change takes place,—the beds become coarser and stronger, and the fracture more silicious. The mica-slate, or mica-schist, passes, by gradations, to quartzite, with seams of mica and sometimes some hornblende, while some of the intervening beds have the character of compact gneiss. The more silicious beds are often traversed by seams of calcite, with also some veins or seams of decomposing feldspar and soft slaty matter.

The hard, silicious beds continue to about 6,000 feet, beyond which there are alternations of a gneissoid character; and between 6,250 and 6,400 feet the whole gradually passes into a granitoid gneiss, which becomes less and less micaceous, till the rock assumes a coarse crystalline character. At about station 10,000, there is a mass of epidotic rock, consisting of epidote and crystals of feldspar, having a thickness of about fifty feet. At 10,250 feet, the rock is soft, as if from partial decomposition; and near 10,500, masses of epidote rock are intercalated or interstratified with the granitoid rock. This now becomes gradually more gneissoid, and there are apparently some alternations of micaceous beds towards the east, precisely as on the west side of the same rock. Between 10,500 and 10,800 feet, there are some silicious beds, and also conglomeratic; and the granitoid gneiss recurs again after passing station 11,000.

Near the central shaft there is a silvery mica-schist, some portions of which are quite soft, and contain garnets. It is the same rock through which the central shaft has been sunk.

From the central shaft, eastward, the prevailing rock is soft mica-schist, the beds sometimes more micaceous, and at a few points, harder and more silicious. The rock has a gentle dip to the eastward. There are frequent slight alternations in quality and texture of rock in passing towards the eastern end of the Tunnel, and the strata generally become more fissile,

and softer ; so much so, that the rock on the eastern face of the mountain has been termed a talcose slate.

In both the eastern and the western divisions, the rock is traversed by quartz seams, sometimes not more than an inch in thickness, but frequently several inches, and, in a few examples, from one to two feet ; and one seam is more than four feet in width for a portion of the distance exposed. The beds are likewise traversed by seams of decomposing feldspar, accompanied by soft shaly matter ; and these are more common where there has been a slipping of the strata along a seam or joint. The quartz seams are usually more firm, though not unfrequently accompanied by soft, decomposing material. Reference will be made to these seams in another part of the Report.

#### DIP OF STRATA.

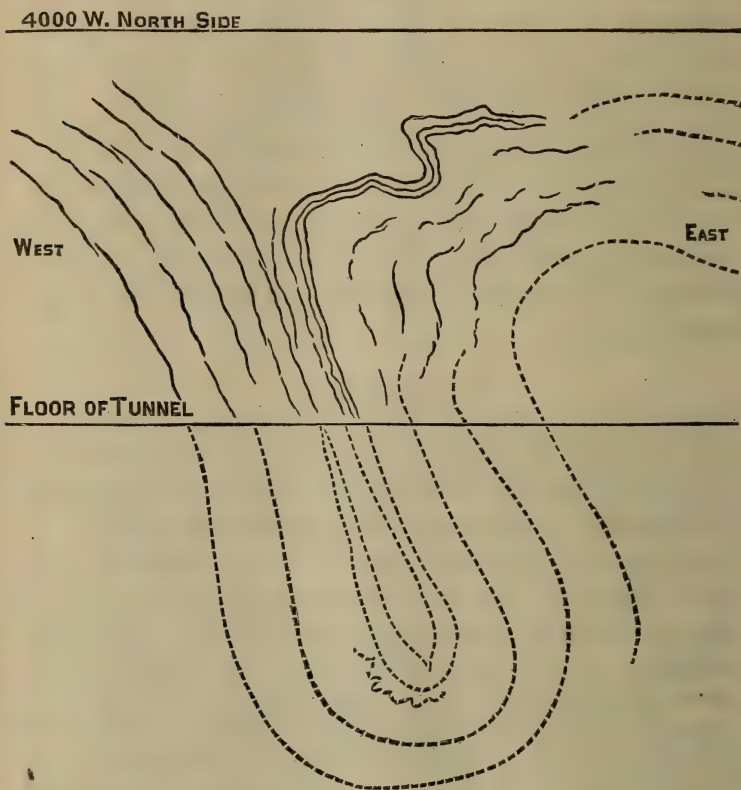
The strata throughout the mountain, so far as can be determined by many observations, have a general easterly dip, varying in different parts of the Tunnel, and subject to extreme local variations in many parts of the western division.

From the west portal the beds dip to the eastward at an angle of about  $45^{\circ}$ , and at several points farther on, the dip appears to be much greater, approaching to  $60^{\circ}$ . A critical examination of the rocks, between 3,000 and 5,000 feet in the western division, shows great irregularities in the dip, with considerable folding and contortion in the beds. The rate of dip sometimes falls as low as  $20^{\circ}$ , and even less for short distances ; while, in a few points, the strata are apparently quite horizontal. These conditions, however, I conceive to be only of local extent, and such irregularities do not affect the general conclusions regarding the easterly dip of the strata forming the entire mountain.

These minor foldings, which may even give reverse dips for short distances, are due to the action which has elevated the westerly side of the mountain, or depressed the central portion, and this has resulted in the folding and partial crushing of some of the intermediate parts.

To work out carefully these local changes of dip and the foldings would require much time. A single one of these examples is given on the next page—the continuous lines

showing what is visible in the section, and the dotted lines representing the probable continuation of the beds below the floor of the Tunnel.



As a rule, the high dips continue throughout the granitic beds, gradually declining towards the central shaft. Going eastward from the central shaft, the dips are low, varying in some parts from  $15^{\circ}$  to  $20^{\circ}$ . These low dips are due to gentle undulations of the strata, and not to any pressure or crushing, as in the western division. The dip of the beds gradually increases, till at 9,900 it is about  $40^{\circ}$ , afterwards becoming about  $70^{\circ}$ , which is the prevailing rate of dip for the greater part of the distance to the eastern portal.

There is much greater regularity in the character of strata and of dip in the eastern division than in the western; and



the first thousand feet from the eastern portal present no points of irregularity in dip or condition of beds.

As regards "the probable effect of the agencies now in operation, or that are likely to be in operation, in changing the character of the rock, or in any way affecting the safety of the Tunnel," we may note the following conditions.

You have removed from the mountain solid materials which filled a space of  $20 \times 24$  feet in height and breadth, and for a length of nearly five miles; essentially twelve millions of cubic feet of rock. The removal of this material has disturbed the equilibrium of pressure and tension established through geological ages. The tendency at once will be a movement, however imperceptible, to restore this equilibrium of pressure and tension. Slight and inconsiderable as this may be, it will nevertheless operate upon the mass adjacent to the Tunnel, and will be felt in the vertical jointings, and in the lessening of cohesion in the laminæ of bedding, especially in the parts with low dips.

I conceive that the pressure of the mountain mass above the Tunnel must be considered as one of the agencies at work, affecting the safety of the roof; and that this influence will be most apparent where the strata are much cut by vertical joints, and where the beds lie at a dip below  $30^\circ$ . The operations of this cause will not be at once apparent, but will continue for a period of years.

Besides this action, which may be considered that of gravitation, the agencies in operation are water, air and frost.

There is in all the rock throughout the Tunnel a tendency to decay, or decomposition, by the simple action of moisture and air, and this is hastened by the effects of frost during a part of the year. This tendency to decay is not uniform throughout the Tunnel, nor even in all parts of a rock designated by the same term. There are intercalated softer laminæ, or beds, which in the original deposition were of different constitution and composition. These may be more or less pervious to water than the adjacent or prevailing rock. Where these are more pervious, the water finds its way along them, softening and partially decomposing them. In many cases it may be little more than a mechanical action by which the parts crumble and fall away; in other cases the

water, percolating through the roof and carrying in solution a notable proportion of carbonic acid, more effectually attacks certain minerals which constitute portions of the rock, or distinct seams cutting the strata.

In many instances there are seams of feldspar, or feldspar and quartz, with nearly or quite the same inclination as the lines of bedding, which sometimes appear to have been a part of the original deposition, and at other times occur as veins. From the decomposition of the feldspar the mass becomes a soft clay, and as these seams are usually the course of water, in greater or less quantities, the material is gradually carried out, leaving a depression along the line. Not unfrequently, in such situations, the strata on one or both sides of the seam become permeated with water, and loosened to such an extent as to crumble away slowly, and if jointed, to fall in masses of greater or less extent. The effect of this action has often extended to several inches on either side, and sometimes a place of one or two feet in width is seen, always moist, and frequently with oozing or dripping water. Even without such seams of different materials, when water finds its way along the lines of jointing or of fracture, the rock becomes disintegrated and more or less rapidly destroyed.

In the line of these joints, or in the lines of fracture, there has been frequent slipping of the beds, which has polished the adjacent faces of the rock, and usually left some soft or crushed material in the interspaces. The percolation of water will remove these materials, leaving the adjacent parts unsupported, which gradually must crumble and fall. All soft seams, whether along slipping joints of the rock, or as veins of other material, will continue to be influenced by the action of water and air; and all such, beyond the dimensions of one or two inches, require careful investigation and protection.

In some places noted, the entire rock is feldspathic in composition, and the softening goes on over large areas. This rock, however, will decay somewhat slowly, and, in the absence of joints, will not be likely to fall in large masses, or to become suddenly dangerous.

Certain portions, and notably some beds between stations 3,400 and 4,000 of the western division, are so feldspathic in

composition as already to have become softened and decomposed to a moderate depth; and this process will continue in the future as in the past. The slipping joints, with the slickenside faces of rock, are frequent in the western division.

The danger from these causes depends upon the amount of water and the rate of decomposition; and also, whether the water is limited by a single seam or joint. Whenever the rock is so much jointed that the water percolates over much area, or the quantity of water is great, there is danger of masses falling from the roof.

When the materials loosened and falling shall have been removed, a similar condition will still exist, until, if left alone, the arch shall have become so pointed above as to leave no chance for loose materials to fall.

The conditions existing which are to be considered in providing for the safety of the Tunnel, are: first, the jointed character of the rock for much of the distance in the western division; and, second, the slipping and sometimes crushing of the beds, either along the plane of the natural joints, or along the line of fracture of the strata; also, the veins and seams traversing the rock and becoming softened by the action of water, and the gradual disintegration of some of the beds in place, and their slow decomposition and removal.

These are not all to be understood as imminent of danger; but the roof with much jointed structure, and if also there have been slips, is to be regarded with distrust, and considered as dangerous or doubtful, requiring protection. When this condition is coupled with the dripping of water, and especially if in situations exposed to freezing, the roof must inevitably soon fall.

I hold that even the strongest portions of the roof, if exposed to the alternations of extreme heat and cold, with the freezing of the dripping water, will give way in a few years.

I am not advised as to the intention regarding protection against freezing; but I am informed by the superintendent of the eastern division that the frost penetrated from the portal for more than half a mile; and that the amount of dripping water from the roof was sufficient to form icicles from roof to floor, and thence gradually up, filling the interstices; and, but for frequent removals, would have become a solid



mass. Such a condition, if suffered to continue, would of course destroy any roof, whether of stone or brick.

2. "To report as to the amount of brick arching required in order to render the Tunnel safe for the transit of cars."

I have given, in the following pages, a general summary from my notes of observation upon the roof and walls of the Tunnel, as I passed through it. The stations are marked in the margin, and my estimate of the condition placed in the columns of good, doubtful and bad.

I will communicate, as an appendix, an abstract of my notes made at each station, that you may have the data upon which my conclusions have been based.

From the western portal to the distance of 2,200 feet, the Tunnel is already arched; between this and 2,447 (West shaft), all is weak ground. I believe preparations are already made for arching; and I need not include this portion.



## WESTERN DIVISION.

	Strong ground, may stand without arching.	Doubtful ground, may stand after careful trimming; needs watching.	Bad or weak ground, needs arching.
	Feet.	Feet.	Feet.
From 2,447 to 3,550,* . . . . .	—	215	888
3,550 to 4,000, . . . . .	430	—	20*
4,000 to 4,100 (needs arching on one side), . . . . .	—	—	50
4,100 to 4,325 (arch begins at 4,192), . . . . .	—	—	225
4,325 to 4,510, . . . . .	—	185	—
4,510 to 4,620, . . . . .	—	—	110
4,620 to 6,400, . . . . .	1,780	—	—
6,400 to 6,650, . . . . .	—	—	250
6,650 to 6,700, . . . . .	—	50	—
6,700 to 7,000, . . . . .	300	—	—
7,000 to 7,200, . . . . .	—	—	200
7,200 to 7,400, . . . . .	—	200	—
7,400 to 7,700 (except a vein of felspar and decomposed rock at 7,550), . . . . .	300	—	—
7,700 to 7,800, . . . . .	—	—	100
7,800 to 8,500 (some parts of this may prove sound), . . . . .	—	700	—
8,500 to 8,700 (arching begins at 8,550), . . . . .	—	—	200
8,700 to 8,800, . . . . .	—	100	—
8,800 to 8,950, . . . . .	150	—	—
8,950 to 9,300 (weak and uncertain), . . . . .	—	—	350
9,300 to 9,400, . . . . .	—	100!	—
9,400 to 9,600, . . . . .	—	—	200
9,600 to 10,150 (requires trimming and careful examination), . . . . .	550?	—	—
10,150 to 11,300, . . . . .	—	—	1,150
11,300 to 11,400, . . . . .	—	100	—
11,400 to 12,000, . . . . .	—	—	600
12,000 to 12,194 [good?],† . . . . .	194	—	—
	3,704	1,650	4,393
			1,650
			3,704
			2,447
			12,194

\* This doubtful ground is between 2,447 and 2,750—75 feet; between 2,750 and 2,800—50 feet; 2,800 and 2,915—50 feet; and 2,915 and 3,050—40 feet.

† This roof, however good, will require to be arched near the shaft.

## EASTERN DIVISION.

	Strong ground, may stand without arching.	Doubtful ground, may stand after careful trimming; needs watching.	Bad or weak ground, needs arching.
From Portal to station 600, good, with the exception of an open wet joint at 150, which requires special attention, and another of less consequence at 590, . . . . .	600	-	-
600 to 925 (good if kept from freezing),* . . . . .	325	-	-
925 to 975 (wet joints), . . . . .	-	50	-
975 to 1,000, . . . . .	25	-	-
1,000 to 1,010, . . . . .	-	-	10
1,010 to 1,030, . . . . .	20	-	-
1,030 (a wet joint in roof).			
1,030 to 1,275, . . . . .	245	-	-
1,275 (a quartz vein in roof).			
1,275 to 2,130, . . . . .	855	-	-
2,130 (a quartz seam, slowly decomposing).			
2,130 to 2,300, . . . . .	170	-	-
2,300 (a moist soft joint or slip).			
2,300 to 2,615,† . . . . .	315	-	-
2,615 (a feldspar seam).			
2,615 to 3,925, . . . . .	1,310	-	-
3,925 (a quartz seam).			
3,925 to 3,980, . . . . .	55	-	-
3,980 (a quartz seam).			
3,980 to 4,500, . . . . .	520	-	-
4,500 (a quartz seam).			
4,500 to 4,515, . . . . .	15	-	-
4,515 to 4,525, . . . . .	-	-	10
4,525 to 4,590, . . . . .	65	-	-
4,590 to 4,600 (a narrow wet seam),	-	10	-
4,600 to 4,840, . . . . .	240	-	-
4,840 to 4,860, . . . . .	-	-	20
4,860 to 5,040, . . . . .	180	-	-
5,040 to 5,060 (a soft feldspar vein and vein of quartz farther on), .	-	20	-
5,060 to 5,720, . . . . .	660	-	-
5,720 (a crystalline seam).			
5,720 to 5,819, . . . . .	99	-	-
5,819 to 5,858 (perhaps a greater extent of weak ground, arch begun),	-	-	39
5,858 to 6,000 (rock more slaty), .	142	-	-
6,000 to 6,600, . . . . .	600	-	-

\* A wet joint at 590; a slip in roof at 600, and at 725 a seam of crystalline matter with softened rock on each side, will decompose slowly; not dangerous.

† 2,525 to 2,550 may be examined for quartz seams and the slow influence of decomposition. Other quartz seams before coming to 2,300.

## EASTERN DIVISION—CONTINUED.

	Strong ground, may stand without arching.	Doubtful ground, may stand after careful trimming; needs watching.	Bad or weak ground, needs arching.
From 6,600 to 6,640 (an oblique seam with water and decomposing rock), .	—	40	—
6,640 to 6,925, . . . . .	285	—	—
6,925 (a joint on south side).			
6,925 to 7,000, . . . . .	75	—	—
7,000 (a weak seam, dripping water).			
7,000 to 7,310, . . . . .	310	—	—
7,310 to 7,350, . . . . .	—	—	40
7,350 to 7,460, . . . . .	110	—	—
7,460 (seam on south side).			
7,460 to 7,600, . . . . .	140	—	—
7,600 (a seam in roof).			
7,600 to 7,680, . . . . .	80	—	—
7,680 (a joint cutting shale, with much water).			
7,680 to 7,690, . . . . .	—	—	10
7,690 to 7,710, . . . . .	20	—	—
7,710 to 7,720 (a quartz seam extending perhaps ten feet), . . . . .	—	—	10
7,720 to 8,075, . . . . .	355	—	—
8,075 (a cross-joint with water).			
8,075 to 8,125 (notably at 8,110), . . . . .	—	—	50
8,125 to 8,425, . . . . .	300	—	—
8,425 to 8,440, . . . . .	—	—	15
8,440 to 9,000, . . . . .	560	—	—
9,000 to 9,215, . . . . .	—	215?	or 215
9,215 to 9,575, . . . . .	360	—	—
9,575 to 9,725 (much rock fallen between 9,625 and 9,650), . . . . .	—	—	150
9,725 to 9,800, . . . . .	—	75	—
9,800 to 10,800 (enlarged for arching in part), . . . . .	—	—	1,000
10,800 to 10,900, . . . . .	—	100	—
10,900 to 12,837, . . . . .	—	—	1,937
	9,036	295	3,506 295 9,036
			12,837

The total amount of ground in the western division, which requires arching before it be made safe for the transit of cars, as shown in the schedule, is 4,393 feet :

Of doubtful ground, . . . . . 1,650

Of ground regarded as safe and trustworthy, 3,704

In trimming the roof, it is not improbable that many places, now regarded as doubtful, will be found quite unfit to be left without arching ; while some that appear strong at the present time may develop the existence of joints, which will render it doubtful or unsafe to leave without support.

In making an estimate for the amount of arching required in this division, dependent on a more critical examination of the parts, I would not be willing to state it at less than the sum of the bad and the doubtful ground, which amounts to 6,043 feet. The remaining ground may be considered safe for some time to come ; but I regard it as almost certain that nearly the whole extent of the western division will ultimately require to be arched with brick.

In the eastern division, the extent of ground regarded as bad is 3,506 feet, to which may be added 295 feet of doubtful ground, making, altogether, 3,801 feet. It is possible that some of the jointed strata, which are now considered as doubtful or bad ground, for a comparatively small distance, may prove to have a greater extension than I have supposed, and you may have to add somewhat to the estimate which I now make from the knowledge acquired during the few days of my investigation, coupled with that derived from the experience of the superintendents of the work during its progress.

There seems no reason to doubt the stability of the strata forming the roof of the greater part of the eastern division of the Tunnel, depending, as I have said, upon their steep and regular dip. But even here the slow processes of decomposition and disintegration will go on, aided by the action of water and frost, when the time will come when the necessity of arching this portion, also, will have to be considered.

3. " To give any other information that you may be able to give, as a geologist, as to the best means of making said Tunnel *perfectly* safe for the passage of passenger trains."



After you shall have decided to arch the dangerous and weaker portions of the roof of the Tunnel, it may not, perhaps, be out of place for me to suggest that provision be made for carrying off the water at the sides of the arch, that it may enter the Tunnel below, instead of being allowed to filter through the arch, as it now does in some parts of that already erected on the western division. The constant percolation of water, and especially when charged with carbonic acid, will gradually dissolve the cement and destroy the cohesion of the parts. Add to this the possibility of freezing, and you have a serious agent of destruction in constant operation.

Should it be decided that there are some portions of the doubtful work which may be considered strong enough to do without arching, for the present, at least, still all such places, except in the firmer ground towards the eastern end, should be carefully watched, and a weekly examination be made by competent and judicious persons, who should pass through the Tunnel on a platform carriage, made high enough to admit of proper inspection and sounding of the roof in all those parts. By such a course accidents would be avoided, and any change in the condition of the rock would be detected in time to prevent it from falling in masses.

Another consideration has occurred to me, which may, perhaps, more properly belong to the province of the engineer than to that of the geologist: it is, that in arching with brick to protect the roof, the arch need not come to the ground on either side; but, by cutting back at the spring of the Tunnel arch, the brickwork may be started upon the stone wall, when the latter is sound enough to sustain it, as would generally be the case. By this process much labor would be saved in the cutting away of the rock in the lateral walls, and much labor and materials saved in the construction of the brickwork. In such a plan, narrow channels should be cut in the stone below the brick, for the passage of all water from the roof to the floor of the Tunnel.

Wherever any portions of the roof which are now wet or dripping water shall be deemed sound enough to stand without arching, especial care and watchfulness should be bestowed upon them; and both from these and all other places the water coming from the roof should be conducted as rapidly as

possible, and over as narrow a space or surface of the rock as possible, to the floor of the Tunnel. Above all things, the freezing of the moist or saturated surfaces should be guarded against, as inevitably destructive to the firmest rock of the Tunnel. The action of frost is already perceptible in the exposed softer slates for some distance from the eastern portal.

Should this continue to be exposed to the effects of frost, as heretofore, there will soon be necessity for trimming the roof, at least once a year, to remove such portions as shall have become too much decomposed to cohere, or such as may have been separated at any fracture or fissure.

There will be little danger of any large masses suddenly falling in this division, at any point where the dip is at  $40^{\circ}$  and upwards; and such dip the beds have from about station 8,000 to the eastern portal. The falling of materials will be from gradual decomposition and crumbling of the rocky mass, or from the same action more rapidly affecting seams of softer material, or those of alternating harder and softer laminæ, which often occur in the same seam or vein; but they are of such a character that I do not apprehend danger from them until the process of decay shall invade the adjacent rock so far as to leave wide openings and unsupported layers on either side.

All portions of the roof which may be cut by vertical or oblique joints, whether included in that recommended for immediate arching or otherwise, will need careful watching and frequent trimming, and, finally, arching with brick. This is more emphatically true of all those parts which are now dripping with water, as I have already stated.

In closing my communication, I can only express my regret that more time could not have been given to the examination of the work, in order that fewer points might have been left in doubt; but with the data and suggestions here furnished, together with the abstract of my notes, and the report of my colleague in geology, you will find all the information which may be required by your able corps of engineers.

I am, very respectfully,

Your obedient servant,

JAMES HALL.

## NOTES BY JAMES HALL.

## HOOSAC TUNNEL.—WEST OF CENTRAL SHAFT.

STATION 2500. On south side of centre, clay-seam; indicates slipping of surfaces. This point needs support and protection. Also, at 8 or 9 feet,—another seam dipping to south. Between 2500 and 2550, a cross-joint or dike, throwing the rock a little. Whole distance between 2500 and 2600, many joints along roof parallel to direction of Tunnel. Ground better on north side, but bad on south; may be said to be doubtful ground.

2550. After passing 2550, joint in roof containing loose pieces. Bad place in centre of roof, cut by numerous joints, leaving triangular pieces.

2620. Very bad slip-joint in the roof, with some very bad pieces.

2700, from 2620, a slip-joint, not very bad, along south side.

2715. Bad joint, especially on south side; joint with clay. A piece of the roof requires critical attention.

2750 to 2900. Better ground to near 2900. 2850, all wet ground with wet joints, and may be considered doubtful and requiring very careful attention. Just before coming to 2900, ground becomes worse, with some wet joints.

2900. Loose seams and water; very bad ground; slips; close joints.

2915. Ground pretty good till reach 3000.

3000. A seam begins running east, parallel with Tunnel, making ground doubtful. Close joint, parallel to and on south side of Tunnel, requires consideration.

3100. A slip in roof. Near 3100, in centre of roof, several slip-joints, and several pieces fallen out.

3125. Bad slip-joint, making ground very dangerous.

STATION 3200, from 3100. All bad ground. Many slip-joints in roof, which render rocks liable to fall.

3200 to 3300. Similar to that from 3100 to 3200. A glazed slip on south side and overhead in middle; north sides, in some places, better and safe.

3375. A slip or joint of one foot or more of mud, slate and quartz—loose; across Tunnel, showing slickensides.

3300 to 3400. Rock full of slips. Rock often cracked; surfaces smooth from sliding.

3450. Same bad ground continues from 3400. Roof full of slipping joints, and dangerous.

3550. Same description as from 3400.

3550 to 3600. Better ground.

3600. Transverse joint and slip; slightly wet, but not apparently dangerous.

3600 to 4000. By careful trimming, roof may be made safe. Good ground to 4000. Rock better; almost entirely free from glazed slips, and rarely any slickensides.

3975 to 4050. On north side, seam in roof. In some places is open, and needs support from north side. The south and principal part of roof is good.

4050 to 4192. Roof and sides good to this point.

4300 to 4325. Roof very bad.

4510 to 4600. Change in ground. Many seams in roof-joints, with crystalline filling and striated surfaces; some water.

4600 to 6400. Quite free from joints and slickensides. Rock torn apart at the blast-holes,—not separated at joints,—leaving impression of blast-holes; very dry.

6400 to 6500. Seam in rock running to south side, at 6500, leaving roof supported, owing to dip north. Granite rock.

6530. Arch of 10 or 20 feet will furnish protection. Granite vein cuts Tunnel, arching westward to about 6575 in roof. About 2 feet thick of decomposing mica and hornblende, making loose, shaly mass; wet.



STATION 6600. Joint and dropping water near centre of roof. Some pieces may fall.

6650. Joint on south side leaking much water. From 6600, seams crossing roof obliquely, dripping water, and needs careful examination to see that there are no loose joints.

6700. Some loose joints—not very bad; require attention.

6700 to 6900. Roof and sides good and strong, with few joints and no slips.

7000. Just before reaching 7000, the roof becomes jointed with crossing joints, leaving some loose masses.

7018 and onward to 7200. Many loose joints, containing soft, crumbly material; somewhat wet. Ground on north side is very bad; loose joints with thin layers of matter. South side better. All roof needs attention. Ground dangerous on north side and north half of roof.

7200 to 7400. Seems firm and secure; needs trimming, but not arching.

7550. Loose vein of feldspar, decomposing. Arching over to the east, perhaps safe, but to be looked after.

7700. Begins a vein of feldspar, decomposing; cuts across sides and roof, rendering ground unsafe, and runs to 7775.

7900 to 8000. Open joints dripping water; otherwise not appearing bad.

8000. Much water on north side. Feldspar seam; appears solid, but should be carefully looked after in trimming.

8050. Seam of soft feldspathic granite, decomposing slowly by action of water.

8100. Same as 8050; all seams wet.

8400, just past 8400. Soft feldspathic seam on south side, running obliquely west, but very thin and close. In roof on south side, soft and loose, but dry.

8500 to 8550. Appears as if arch ought to continue westward to 8500, along open seam. Seam quite open at 8522.

8600 to 8700 eastward. Ground decidedly bad; feldspathic seams and wet; indicate decomposition.

STATION 8700. A decided change for the better, and joints disappear. After 8750, some loose pieces in roof, which need to be trimmed off; also at the same point (8750) a dripping of water showing that care is required.

8750 and eastward, Same condition as 8600 to 8700. To 8800 much dripping of water. Roof should be carefully looked after; substance of roof of good character.

8800 to 8950. Roof good.

8950. Strong seam on north side, bearing much water; should be looked after. Seam at 8950 crosses Tunnel obliquely, reaching south wall at about 9015; ground, 8950 to 9015, not reliable, having other causes of weakness.

9035. Seam of decomposing feldspar crosses roof diagonally, and makes bad roof.

9115 eastward. Little better for 50 feet, thence same bad feldspar seam and water to 9200.

9275 to 9300. Ground a little better.

9380. Much water coming in on south side of Tunnel; joint nearly parallel to Tunnel.

9400. A little beyond 9400 another joint, bearing much water; roof and sides bearing much water all the way to 9600. Must be considered doubtful; needs arching.

9600 to 10150. Roof seems good; no danger.

10300. Ground very bad; coarse crystalline granite, decomposing into mud.

10350 to 10700. Same condition as 10300.

10700 to 11050. Same as 10350 to 10700; some parts very bad, and in constant danger of falling. Many seams and much water.

11050 to 11300. Some broken and jointed roof; small joints, cutting ground into small pieces, continue to about 11300, where the roof is a little better in places, but not considered safe.

11300 to 11400. Roof mostly sound and dry; probably can be made safe by trimming.

STATION 11400. A little broken, with leaking ground.

11450. Roof becomes dry, but still jointed.

11500 to 11600. Better roof.

11750. Very bad place in roof; needs careful trimming. Loose joints for considerable distance, and continued to 11850.

11850. Rock becomes more slaty, and roof very dangerous.

11900. Joint across roof, with much water on north side.

11900 to 12000. Same conditions; continues growing worse than before.

12000. Here begins a little better roof, continuing to *Central shaft*. Few joints; all dry; many half drill-holes remaining in roof.

#### HOOSAC TUNNEL.—EAST OF CENTRAL SHAFT.

STATION 600. Small slip in roof, leaving some loose rock, which may be removed, leaving roof safe.

1000 to 1010. A wet slip, running obliquely to Tunnel, spreads in roof, involving about 2 feet of thickness,—not *presently bad*; may at some future time require protection.

3980. Soft seam, wet and decomposing; not dangerous.

4860. Soft vein, rising nearly in plane with bedding of rock, cutting strata in roof. Much loose matter has fallen from roof; needs some attention.

5040. Soft joint or vein of feldspathic matter arching the whole tunnel,—1 foot wide; but affects rock for about 4 feet in roof; not presently dangerous, but will crumble slowly. Roof good to 5040.

5700. Rock becomes more slaty.

5720. Seam of crystalline matter arching over Tunnel. Rock safe on each side; will decompose slowly.

7600. Short joint, on south side.

7680. Joint across Tunnel, with much water.

STATION 7720. Quartz vein crossing roof; decomposing slowly. Roof good to 7720.

8100. Vein crosses roof, dividing into several, on north wall; rock between crushed and infiltrated with quartz and feldspar. About 25 feet bad.

8435, and in roof at 8440, sloping backwards; soft vein, inter-laminated with harder layers, needs attention.

8500. Short joint on north side; may require looking after, but will not extend.

8550. Joints dripping some water; crossing Tunnel; can do no harm.

8620. No change. Sound, dry rock; very strong.

9000. Joint beginning on north side, running obliquely outwards, so that arch of roof rests upon it; close and strong; no danger of sudden falls.

9100. Joint begins as a double line, and runs parallel to 9135.

9130. Quartz vein from 9200, dividing at this point. Not unsafe east of 9130.

9200 to 9215. Soft seam, 15 inches wide, crossing Tunnel at angle of  $75^{\circ}$ . Roof good each side.

9300 to 9400. No change from 9500.

9500 from 9575. Roof very good and strong; no joints of importance, and continues to 9400. Dip high.

9575 from 9725. The roof cut by numerous joints in different directions. At one point some tons of rock have fallen from roof (9625-9650); all very dangerous.

9725 from 9800. Roof better; not so good just at 9725.

9800. Soft, wet seam crossing from south side over roof. Other joints and loose pieces in roof; wet in places. Dip gradually rising; is now about  $40^{\circ}$ .

9900. Slip or joint along north side. Same condition of roof as before noted. Many wet joints, with water and slips. Longitudinal joints, which have been following along the roof (10600), crossing to south side, causing much bad roof.



STATION 9975 to 10100. Enlarged for brick arch.

10000. Roof very dangerous; roof much cut by joints in various directions. Joints wet, and roof falling.

10100 from 10200. Condition worse, if possible. Many joints; principal one on north side; shorter ones on south side. Some masses lately fallen from centre of roof. Now contains many loose pieces. Mr. Blue states it was entirely trimmed of loose ground one and a half years ago.

10200. Wet joint running nearly to 10300, on north side of Tunnel, dripping much water. Some cross-joints very dangerous.

10300 from 10400. No change worth noting.

10400 from 10500. Same kind of roof as before—with joints worse, if anything. On south side very bad, and near the station worse on north side.

10500 from 10600. Same joint on south side of Tunnel, with cross-joints in roof; many loose pieces in roof; little water. Blue says it was some time ago trimmed and made sound; is now quite loose.

10600 from 10700. Very bad roof, joints cutting in several directions, leaving very bad roof. Some joints wet. Water dripping all along. Pieces have fallen from roof.

10700 from 10800. Dangerous slips or joints, and pieces of roof liable to fall at any time.

10800 from 10900. Roof better; drill-holes showing; dry, with no important slips.

10900 to 10915. Slip across roof; and another on south side.

11000. Same kind of roof and walls, with joints and loose pieces in roof. A soft clay seam crossing roof at this point, from which pieces have fallen.

11100. Roof flaky and shaly, with cross-joints, and in danger of falling.

11200. Roof, since passing 11400, very shelly. Sounding roof shows many pieces loose and ready to fall. Loose pieces lately removed.

11300. Same kind of roof as 11325; roof flaky and shaly.

STATION 11325 to 11375. Enlarged for arching; wet slipping joint.

11400. Roof with few joints. Just east of 11500, joint running entirely across Tunnel and up each wall.

11500 to 11600. Generally same conditions as last 100 feet; few joints, though several at 11500. Roof very flat. Rock generally good.

11600. Generally a little better roof from 11700; no slips of consequence; strata generally too flat.

11700. Diagonal joint crossing to north-west over roof of Tunnel.

11735 to 11843. Already enlarged for brickwork at 11800. Soft decomposing seam, one foot thick at base, increasing to five feet in roof.

11900. Joint running up side Tunnel and across roof. Between 12000, and 11900 one cross-joint, dripping much water from roof. Going east, wet joints again.

12000. A little better, but some joints, and roof flat; quite dry.

12150. Cross-joint from base across roof; wet in roof; no drill-holes showing in roof. Roof weak from joints to 12000, where it becomes free from joints.

12200 to 12300. Same broken condition as 12300 to 12400, with little water so far as observed. Almost no marks of drill-holes left in roof.

12300 to 12400. Continuous joint along south side; north side with regular joints and wet slips, leaving roof without support.

12400. Roof same kind as at 12500, with joints, leaving portions ready to fall, and some water at intervals. Diagonal seam or joint across roof.

12500. Slip; rock cracked, joints on south side; some water.

12550. Wet slip on north side, and a joint along the centre.

12600. Longitudinal and cross-joints in roof; a little water on north side.

12837. Wet slips at side, running up nearly vertical, making bad ground.

REPORT OF T. STERRY HUNT.

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To Dr. P. A. CHADBOURNE, *for the Corporators of the Hoosac Tunnel.*

SIR :—In obedience to the instructions received from you, dated September 14, 1874, naming me one of the experts to examine and report upon the condition of the Hoosac Tunnel, in accordance with section 5 of Senate Document No. 361, 1874, I have the honor to inform you that I made an examination of the Tunnel on September 22–26, and collected such rock-specimens as were necessary for my farther study, which were duly forwarded to me at Boston. After a careful study of these, and collation of the notes made by me during the examination, I beg to make the following Report.

Following the order indicated in my instructions, I shall begin by noticing the kind of rock and its structure, considered in relation to the safety of the Tunnel. The rock at the two extremities, and for about three-fourths of the entire distance, is a mica-schist or a micaceous gneiss, the two rocks differing from each other in the proportions of their mineralogical constituents, and the mica-schist (or mica-slate, as it is also termed) passing into gneiss by a larger admixture of quartz and feldspar. Many varieties of these rocks may be seen in the Tunnel, from a very soft and flaky mica-schist to a gneiss of great hardness and strength, and these varieties alternate and graduate into each other, as is always the case in the great mica-slate formation of the Appalachians, of which formation these rocks are a part. To the west of the Tunnel there is a cutting through a band of white limestone, but a short distance before reaching the west portal the mica-slate and gneiss formation, in a decomposed state, is met with. Farther in, after passing the long brick arch, at the foot of

the west shaft, a distance of 2,447 feet, the same rocks are still met with, though undecomposed. Thence, to 3,750 feet (counting from the west portal), the same formation continues, sometimes very soft and micaceous, at other times hard and feldspathic. At this point the rock is a dark, very micaceous gneiss, with garnets, and the strata appear nearly vertical. This is followed by a soft mica-schist, but at about 3,900 feet these rocks are replaced by a white, hard, feldspathic rock, sometimes quartzose, occasionally with a little mica in layers. Sometimes it is nearly compact, and at others is coarsely granular, and may be designated a gneiss. The inclination of the strata is high, with many small contortions and a local westerly dip at 4,100, the general dip of the strata throughout the Tunnel being to the eastward. East of the second brick arch (4,192-4,253 feet) a hard feldspathic rock continues, which in some parts is fine grained, almost compact, and white in color, with greenish spots, which are apparently due to the presence of a small amount of diffused light green hornblende, minute prisms of which are in some places to be recognized. This rock, which holds in some abundance seams of calcareous spar, continues up to 6,150 feet, with but little apparent change. Here it becomes coarser grained, and is seen to contain orthoclase-feldspar and quartz, becoming a light colored, somewhat granitoid gneiss. This is more distinctly defined farther on, and is very well characterized at 6,700 feet. It thence continues, with small variations, to about 10,700, where it is succeeded by a grayish-black micaceous gneiss, very like that seen between the west shaft and 3,900. A similar gneiss appears up to 11,050, where the gneiss, still dark colored, becomes very coarse grained, and shows a dip of about thirty-five degrees to the eastward. Beyond this re-appear mica-schists and micaceous gneisses, apparently like those of the western end, which extend all the way to the central shaft (12,764 feet), and beyond it to the east portal, and still farther. These rocks present considerable alterations in quality, as before, and are in some parts hard and gneissic, and in others soft and micaceous. The former character is well seen in the strata from 6,000 to 9,500, and again in the vicinity of 12,000 feet, counting in this eastern half of the Tunnel from the east portal. Near



the central shaft and to the west of it, the rock, as already noticed, has a moderate easterly dip, and this is observed for some distance to the eastward, but at 9,570 feet in the eastern division it increases to forty-five or fifty degrees, and augments until, farther on, the dip becomes nearly vertical. The Tunnel may be described as passing for 25,000 feet through a hill of mica-schist and micaceous gneiss, including in its western half over 6,000 feet of hard feldspathic and quartzose rock, in part a granitoid gneiss.

The decay of the rock seen at the west portal, already noticed, consists in a chemical change, which has converted the feldspar of the gneiss into a clay. The strata still retain their original positions, but the whole mass is so soft as to be readily moved by the spade. This state of decay was, I am informed, found to be complete for a distance of 600 feet from the west portal, where the floor of the Tunnel is 200 feet below the surface of the hill, and was partial at 1,000 feet, where it is 280 feet below. The question has been raised, whether this condition of things is one likely to extend, and to affect the strength and safety of the Tunnel still farther in. I have paid especial attention to the same phenomena of decay, where they are seen to a great extent in the similar rocks of the Blue Ridge in Virginia and North Carolina, and have satisfied myself that the process is one belonging to an age long past, and that at one time the whole of the rocks of Hoosac Mountain were, to a considerable depth, in the same condition. The agencies which have removed the decayed rock from the other parts of the mountain have, however, spared this protected portion at its western base, where it still remains, an evidence of a process which has not since affected the exposed and still undecayed portions of the similar rocks which form the surface of the whole mountain.

The strength and safety of the roof of the Tunnel have much less to do with the mineralogical characters of the rock, or with its stratification, than might be supposed; and, on the contrary, have very much to do with joints and fissures in the rock pertaining to the superinduced structure which belongs to the architecture of the mountain. The strata have, since their formation, been subjected to movements and strains of various kinds, which have not only contorted them, but appa-

rently produced greater or less movements of dislocation, crushing them in parts. As a result of this, joints have been produced which traverse large portions of the rock in directions which have no constant relation to the stratification, and are a source of weakness. In the more fissile or slaty portions of the rock there is a proneness to split or cleave in the direction of the stratification, but this is seldom of much consequence, while, on the other hand, the hard and compact varieties of rock, which have no tendency to cleave in this manner, are often so traversed by joints as to make the roof unsafe. In many cases the prominent joints are nearly perpendicular, and run east and west, coinciding for considerable distances with the line of the Tunnel. It not unfrequently occurs that there are several of these in its breadth, and that the separation of the rock along them forms one or both walls of the Tunnel. These joints, being perpendicular and more or less open, then extend up along the walls, leaving the roof without lateral support. It thus happens that when there are several of these parallel joints in the roof of the Tunnel, and when, moreover, as is often the case, the roof is intersected by other vertical joints running in directions transverse or more or less oblique to these, portions of the rock are left with but little support; and when still other joints or planes of division occur, which are either horizontal or make but a small angle with the horizon, the condition is still more unstable, and angular blocks of greater or less size hang in the roof with insufficient means of support. When, however, these principal vertical joints are oblique to the axis of the Tunnel, the roof is better sustained. This condition of things, which I have endeavored to describe, is more marked in the harder and granite-like rocks than in the softer and more yielding slaty portions in which the fissures are fewer in number, less open, and less important. These softer strata are, however, apt to split in the plane of the beds, and in the parts where these are at a small angle, occasionally make an unsound roof, but where they are at a high angle, form a very firm and solid one. It will thus be seen, that so far as the kind of rock is concerned, the softer varieties afford a better roof than those which are harder and more firm.

A point of much importance in connection with the stabil-

ity of the roof is connected with the percolation of water, which in some places filters slowly through the rock, keeping portions of it wet, while in other places it drips abundantly. Here, again, there is no apparent connection between the flow of water and the kind of rock, some parts of the granitoid rock being very wet, and others dry. Considerable water comes through the mica-schists in the western half of the Tunnel, but the eastern half is, with some few exceptions, dry. The great flow of water during the excavation was a little west of the central shaft. The importance to be attached to the water is twofold: in the first place, it shows the existence of more or less open joints, which are, in themselves, points of weakness, and by the wearing action of the water may become gradually enlarged; in the second place, in those parts of the Tunnel which will be exposed to the action of frost, the freezing of the water in the cracks of the rock will tend to open the joints and thus loosen fragments. The danger from this cause would perhaps be greater where the flow of water is very small, for where it is considerable the temperature of the water, being much above the freezing point, will probably prevent the formation of ice in the fissures. In such localities as permit of its formation, the accumulation of ice either on the floor or on the roof or walls, and its subsequent fall therefrom, are possible sources of danger to be guarded against, and to be carefully studied. I venture to recommend that during the next winter, when the Tunnel will be open (the door at the western end having been removed), observations shall be made within it, at various points, by means of registering thermometers, to determine the minimum temperature and to show how far the frost will penetrate during the continuance of severe cold, with westerly winds. In the eastern half of the Tunnel, the comparative dryness will make such observations less important than in the western, though they should not be neglected. The effect of frost upon the brick arch of 2,200 feet at the western extremity, along which there is a considerable percolation of water, should be carefully studied.

As regards the second point in your instructions; namely, the amount of brick arching required to make the Tunnel safe for the passage of railroad trains, it is a question the consid-



eration of which belongs rather to the civil engineers who are to report upon the work than to myself. I will, however, give some notes of the condition of the roof and of the judgments which I formed on the spot. I examined it from end to end, very carefully, with the aid of lights carried along the roof, and a pole, armed with iron, for sounding it; much of the ground having been gone over twice in this manner.

Beginning at the west portal and counting eastward as far as the central shaft, the first 2,447 feet are already arched or to be arched with brick. From this point to 3,700 feet, the rock is a soft mica-schist, having great parallel fissures running with the axis of the Tunnel and often coinciding with its sides, together with transverse joints, sometimes very flat. Between 2,700 and 2,800 feet are from fifty to seventy-five feet of good roof, but beyond this, to 3,500, the roof, as before, is cut up by longitudinal and transverse seams, and with the exception already named, the whole of this distance of more than 1,000 feet appears to me to be unsafe. From 3,500 to a brick arch, which extends from 4,192 to 4,253, the roof seems to be sound and firm, but beyond the arch to 4,350, there are frequent flat seams, making the roof, in my opinion, uncertain for the distance of 100 feet. Beyond this, up to 6,390, the roof appears firm and good, with one exception to be noted, at 4,050, where an open vertical joint, extending along the north wall, begins, and is continued about fifty feet, the rock appearing loose and unsound for two or three feet to the south of it, although the remaining breadth seemed firm and solid. From 6,390 to 6,410, a distance of twenty feet, the rock, here a granitoid gneiss, is much fissured, and lets fall abundance of water. A similar flow of water through fissures occurs at intervals all the way to 6,700, and the whole roof for this distance of more than 300 feet appears to me unsound. Thence for 300 feet farther, or to 7,000, it is dry and solid, without open joints; but between 7,000 and 7,200, a great, open, vertical joint runs along the north wall, which sounds hollow; the roof here requires attention. Thence to 7,400, it is rough but dry. It shows some large fissures in the last fifty feet, and will require careful watching, as will also the next 300 feet, which are somewhat cut up by seams. This brings us to 7,700 feet and thence to the brick arch



(8,550–8,600) the roof is very good; but beyond the arch for 100 feet, or to 8,700, it is loose and unsound, and will require arching. Thence to 9,050 it is good and sound, but beyond, for fifty feet, or to 9,100, it is cut by great seams, is more or less wet, and appears unsafe. At 9,200, for a distance of ten feet, the roof is much cut up by seams, but with this exception appears good from 9,100 to 9,400. Thence, a distance of 100 feet, to 9,500, it is leaky, with many joints and fissures, and requires to be carefully examined. From 9,500 to 10,260, the roof is free from joints, dry, and seems solid and in excellent condition. From this point for about seventy-five feet, or to 10,335, is a portion much cracked and fissured, with a clayey matter in the joints, while the granitoid gneiss rock is traversed by seams of soft, dark, micaceous material. This part is now timbered and will be arched with brick. Thence to 10,525 the roof appears sound, but from this point to 11,050, it is much cut by joints, is very wet in places, and seemingly unsafe. For 200 feet beyond, or to 11,250, the roof is sound and firm; but for thirty feet farther, or to 11,280, it is again much cut up by joints, beyond which to 11,400, it is sound and dry. From 11,400 to 11,500 it is also dry, but with nearly vertical transverse seams and others nearly horizontal, making the roof seem unsound. From 11,500 to 11,750, it is again sound and firm, but from this point to 11,950, is intersected by joints, as before, is wet, and appears unsound; beyond, to nearly 12,000, the roof is very wet, and is timbered. From this point to the central shaft, at 12,194, the roof is dry and solid.

I now come to the eastern division of the Tunnel, in which the stations are numbered from the east portal westward; but, in my notes, I shall continue in the previous course, from west to east, the central shaft being at 12,837 feet from the east end. From the shaft to 12,764 feet, the roof is in good condition; but thence, for 64 feet, there are parallel joints coinciding with the sides of the Tunnel, and leaving the roof apparently without support. From 12,700 to 12,660, the roof is somewhat better; but thence, for 410 feet, to 12,250 the strata, which have a gentle dip to the east, are soft mica-schists, cut up more or less by joints in two directions, and often giving out a hollow sound when struck. The greater

part of this 410 feet will, I think, require arching. From 12,250, the roof is good as far as 11,825; thence, to 11,735, is a portion of soft mica-schist, very wet, where preparations are now being made for arching. From this last point to 11,385, there is again a good roof, to which succeeds a broken and leaky portion of fifty feet, now being excavated for arching. Beyond this, a joint or seam, nearly parallel to the north wall, extends along it to 11,225, and farther, all the distance to 11,000, are frequent parallel and transverse seams, which make the ground, in my opinion, unsafe for 225 feet. For 900 feet farther, or to 10,100, a somewhat similar condition of things is met with, the roof being intersected with parallel and transverse joints, often somewhat open. Of the former, two or three are frequently seen in a breadth of ten feet, and half-detached blocks in the roof often give it the appearance of great insecurity. The succeeding 150 feet, to 9,950, are now being prepared for arching; and thence to 9,800, there are, as before, many joints, which are often open, while the rock is more or less wet. For 100 feet beyond, or to 9,700 the roof is strong, dry and solid; but beyond, to 9,570, it is again much fissured and insecure. From this point to 9,125, it is good and sound; but thence, to 9,000, the roof is more or less fissured, and requires attention. From 9,000 feet to the east portal, the strata of mica-schist and micaceous gneiss have a high and increasing dip to the eastward, which soon becomes nearly vertical. The roof is sound and dry, and appears safe throughout the whole distance, with the exception of a few short portions, which will require arching. These are at 8,430, where there is a narrow soft seam, dipping with a high angle to the east; a similar seam at 8,125–8,100; two thin seams of soft rock, with much water, at 7,600; and a point beginning at 5,858, where a brick arch of thirty-nine feet has already been built. Beyond this are other points, at 5,050, 4,860, 4,525 and 1,010, where short arches will be required; but with these trifling exceptions, the last 9,000 feet of the Tunnel are, in my opinion, firm and safe.

Reviewing, now, the preceding notes, it will be seen that the portions which I have indicated as unsafe in the west division of the Tunnel, are as follows:—

*West Division.*

A, . 2447 to 3500, . 1,000 ft.	I, . 9200 to 9210, . 10 ft.
B, . 4253 " 4350, . 100 "	K, . 9400 " 9500, . 100 "
C, . 4050 " 4100, . 50 "	L, . 10260 " 10335, . 75 "
D, . 6390 " 6700, . 310 "	M, . 10525 " 11050, . 525 "
E, . 7000 " 7200, . 200 "	N, . 11250 " 11280, . 30 "
F, . 7350 " 7700, . 350 "	O, . 11400 " 11500, . 100 "
G, . 8600 " 8700, . 100 "	P, . 11750 " 11950, . 200 "
H, . 9050 " 9100, . 50 "	Q, . 11950 " 12000, . 50 "
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Total, . . . . .	3,250 ft.

*East Division.*

R, . 12764 to 12700, . 64 ft.	W, . 10100 to 9950, . 150 ft.
S, . 12660 " 12250, . 410 "	X, . 9950 " 9800, . 150 "
T, . 12825 " 12735, . 90 "	Y, . 9700 " 9570, . 130 "
U, . 13385 " 11225, . 160 "	Z, . 9125 " 9000, . 125 "
V, . 11225 " 10100, . 1,125 "	
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Total, . . . . .	2,404 ft.

All the ground which I have thus indicated, making an aggregate of 5,654 feet, appears, in the present state, to be unsafe; but it does not follow that the whole thereof will require arching. At many points, more especially in the eastern half, falls of stone from the roof, from a few pounds to several tons in weight, have taken place during the past few months, from ground which had been looked upon as sound; but it is to be kept in mind that these falls do not indicate an increasing danger, as in the case of stones falling from a weakened and crumbling structure, destined to ruin. On the contrary, each fall of rock from the roof of the Tunnel diminishes the future risk in that spot. The roof has been more or less shattered by the explosive agents used in excavating the Tunnel, and it is the loosened fragments which are now falling from time to time. When these shall all have fallen, the roof of the Tunnel, unless where the disintegrating force of water is at work, will have acquired a condition of stability, a process which, in the course of nature, would, however, require a long time. In many portions of the Tunnel, where I have marked the cracked and jointed condition of the roof, this process will be aided by the removal of the seemingly loose portions of rock, and the necessity for arching dispensed with. This may be found to be



the case with the parts which I have designated by the letters K, M, N, and with parts of V. Where, as in C and E, the weakness seems to be confined to a crack along the side of the Tunnel, it is worth inquiry whether some mode of support by buttresses cannot be substituted for arching. I, however, hesitate to express an opinion as to the probable amount of arching which may ultimately be required to make the Tunnel safe, because it is, I conceive, a matter upon which the civil engineers who are to follow me, are more competent to decide than myself. In indicating, as I have done above, the doubtful portions of the Tunnel, it may be thought that I have erred on the side of prudence; but I have felt in the task a sense of great responsibility, and, in that spirit, have endeavored to form my conclusions.

In closing, I venture to add to the suggestions as to the examinations of temperature, and the effects of the winter's frost upon the Tunnel, that of frequent and regular inspections by means of lights, sounding-poles, and, where necessary, of ladders, of the entire roof and walls. For this purpose, it will be important to retain the services of men who have become familiar with the Tunnel, and who will be able to make intelligent observations as to the changes, if any, which are taking place in its condition. In this way, under careful supervision, it will be possible to get together a body of information as to the Tunnel, which will be of great service as regards the future management of this important work.

I have the honor to be, sir,  
Your most obedient servant,

T. STERRY HUNT.

BOSTON, MASS., October 12, 1874.



## REPORT OF JOSIAH BROWN.

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FALL RIVER, October 13, 1874.

TO WM. B. WASHBURN, Esq., and P. A. CHADBOURNE, Esq.:

GENTS :—In compliance with your request, I have examined the Hoosac Tunnel as carefully as circumstances would admit. I am satisfied that it is impossible to tell with certainty every place that is necessary to be arched, without a careful examination after the sides and roof have been trimmed and all loose pieces removed.

I found a large portion of the sides and roof marked to be trimmed to the size required by the contract. This made it unnecessary for me to sound or examine very closely those parts, as the trimming will change very much the appearance.

The notes that I took when in the Tunnel of the seams and joints, I will give you if desired.

The following, in my judgment, are the stations and distances required to be arched, in order to make it safe for the passage of trains :—

*Stations and Distances required to be Arched.*

WEST DIVISION. <i>West Portal to Central Shaft.</i>		EAST DIVISION. <i>Central Shaft to East Portal.</i>	
STATIONS.	Distances to be Arched.	STATIONS.	Distances to be Arched.
2,447, West Shaft.		12,837, Central Shaft.	
2,447 to 3,500, . . .	1,053 feet.	12,837 to 12,700, . . .	137 feet.
3,975 to 4,180, . . .	205 "	12,650 to 12,350, . . .	300 "
4,250 to 4,350, . . .	100 "	12,000 to 11,950, . . .	50 "
4,400 to 4,575, . . .	175 "	11,850 to 11,700, . . .	150 "
6,400 to 6,680, . . .	280 "	11,450 to 9,810, . . .	1,640 "
6,975 to 7,200, . . .	225 "	9,725 to 9,550, . . .	175 "
7,300 to 7,400, . . .	100 "	9,250 to 9,050, . . .	200 "
7,700 to 7,800, . . .	100 "	8,535 to 8,425, . . .	110 "
7,980 to 8,000, . . .	20 "	8,115 to 8,000, . . .	115 "
8,460 to 8,500, . . .	40 "	7,660 to 7,640, . . .	20 "
8,525 to 8,556, . . .	31 "	7,475 to 7,425, . . .	50 "
8,594 to 8,700, . . .	106 "	6,400 to 6,380, . . .	20 "
8,780 to 8,980, . . .	200 "	5,819 to 5,809, . . .	10 "
9,030 to 9,300, . . .	270 "	5,720 to 5,710, . . .	10 "
9,350 to 9,400, . . .	50 "	5,060 to 5,040, . . .	20 "
9,420 to 9,650, . . .	230 "	4,875 to 4,850, . . .	25 "
9,750 to 10,000, . . .	250 "	4,600 to 4,590, . . .	10 "
10,250 to 11,000, . . .	750 "	2,625 to 2,610, . . .	10 "
11,000 to 12,000, . . .	1,000 "	1,035 to 975, . . .	60 "
12,000 to Shaft, . . .	194 "		
	5,379 feet.		3,112 feet.

West Division, . . . . . 5,379 feet to arch.

East Division, . . . . . 3,112 " "

Total, . . . . . 8,491 feet to arch.

Equal to . . . . .  $1\frac{608}{1000}$  miles.

Yours, respectfully,

JOSIAH BROWN.

## REPORT OF D. L. HARRIS.

Hon. P. A. CHADBOURNE, *of the Boston, Hoosac Tunnel and Western Railroad Company.*

SIR:—Having, in compliance with instructions contained in your communication of the 8th of October, made an “examination of the Hoosac Tunnel with a view to ascertaining how much thereof should be arched in order to insure the safe passage of railroad trains through the same,” I respectfully present the following Report:

The easterly part of the Tunnel, say about one-third of its entire length, is driven through compact and tenacious mica-slate rock, with strata highly inclined to the west, and standing at nearly right angles to the centre line. Through this portion there are occasional seams of rotten rock or soft material, varying from a few inches to two feet in thickness, running across the line of the Tunnel and cutting the regular strata at varying angles. At these points it will be necessary, “in order to insure the safe passage of railroad trains,” that short pieces of arching, amounting in the aggregate to 280 feet, be built. With these exceptions, the side and the roof of the Tunnel present a firm and reliable appearance. So far as the trimming is completed, the contour of the roof is uniformly well defined, neat and suggestive of perfect safety.

At about 9,000 feet (or station 90), from the east portal, a section of 220 feet of arching should be commenced.

Next follows about 330 feet of apparently sound roofing.

Near 9,550 feet from the east portal, there is a marked change in the general appearance of the Tunnel. The rock changes in structure and holds more moisture in combination with its elements. Running water is freely discharged from seams and slips, and the rock-beds are less and less inclined to the horizon, so that before reaching the central shaft they become nearly flat. The “completed” Tunnel loses that

regular and symmetrical figure which obtains in the eastern section, and the exposed rock has a shattered and unstable look. Arching is required all the way.

Going west from the central shaft, the rock formation becomes more granitic, water is very abundant in the seams and slips, stratification is less distinct, with natural beds of the rock nearly horizontal, and the general appearance is such as to leave no doubt that the arching should be continuous to a point not far from 10,000 feet (or station 100) westerly of the west portal of the Tunnel. This would give an unbroken line of arching about one mile long and extending nearly equal distances each way from the central shaft.

From station 100 (10,000 feet) to station 25 (2,500 feet), measuring from the west portal, there is an improvement in the rock formation at some points, though it nowhere compares favorably with that of the east end section. Minerals of alkaline of readily disintegrating character are found in the cross-veins, and it is evident that large portions of the rock bounding the Tunnel are more or less affected injuriously by exposure to the combined influence of air and moisture. In some places arching may be avoided for several hundred feet together, but the safe places are the exceptions. The good and the bad are sadly intermixed. In the whole 7,500 feet now under consideration, there may be in all 2,000 feet that, with proper trimming, will be safe.

From station 2500, onwards to the west portal of the Tunnel, arching is completed.

My conclusions may be summed up as follows:—

Arching is required—	Lineal feet.
In the easterly 9,000 feet of Tunnel at nine places, measuring in the aggregate . . . . .	280
At about 9,100, counting from the east portal, . . . . .	220
Between a point 9,550 feet from the east portal and a point 10,000 feet from the west portal, . . . . .	5,081
Between the last named point and a point 2,500 feet from the west portal, sundry sections, amounting in the aggregate to . . . . .	5,500
Total, . . . . .	11,081

Respectfully submitted,

D. L. HARRIS.





# PROFILE OF HODSAC MOUNTAIN

made to accompany

THOMAS DOANE'S

Report Oct. 13<sup>th</sup> 1874.

SCALE 500 FT TO AN INCH

## EXPLANATION

Behind single lines indicate the stratification of the Rock  
double lines rejected veins  
Dashed lines driven by Nitro Powder  
Already lined  
Brick lined and safe  
To be trimmed to Arch  
lined with brick

## NOTES

Stone lining already in

Brick lining already in

To be lined  
Central longitudinal Seam Run to Gallic  
Bad roof and walls  
All to be lined

To be trimmed to Arch  
with legs in a few places

Bad roof with  
vertical seams  
All to be lined

Good roof  
To be trimmed to Arch

One leg or partial lining  
Already lined  
To be lined. Brandy Entertained

Nearly Safe now  
Good roof and probably made safe by trimming to Arch

East of this line is much better than N. 100°  
We and broken with cross  
Probably should be lined

To be trimmed to Arch

Very bad with stratification seams both sides  
To be lined

To be trimmed  
to Arch

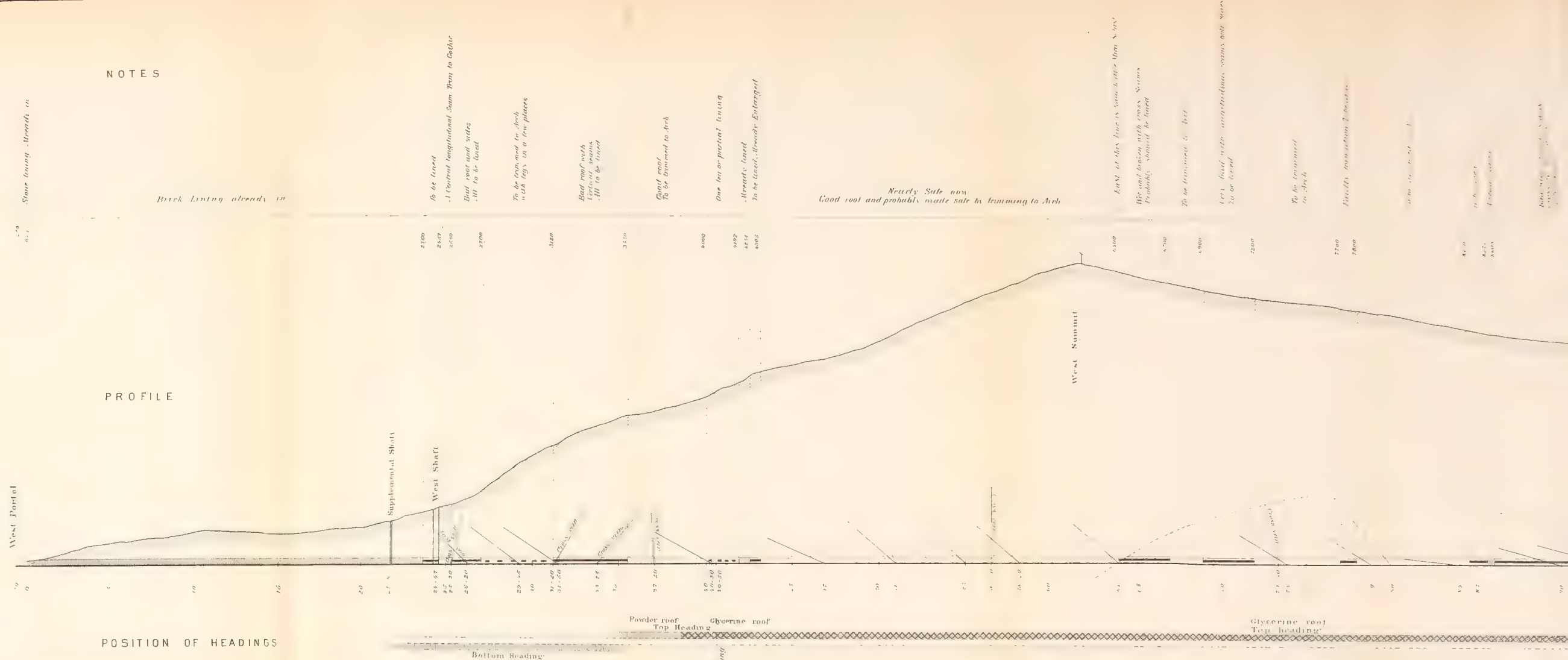
Probably trim to Arch

To be trimmed  
to Arch

To be trimmed  
to Arch

To be trimmed  
to Arch

## PROFILE

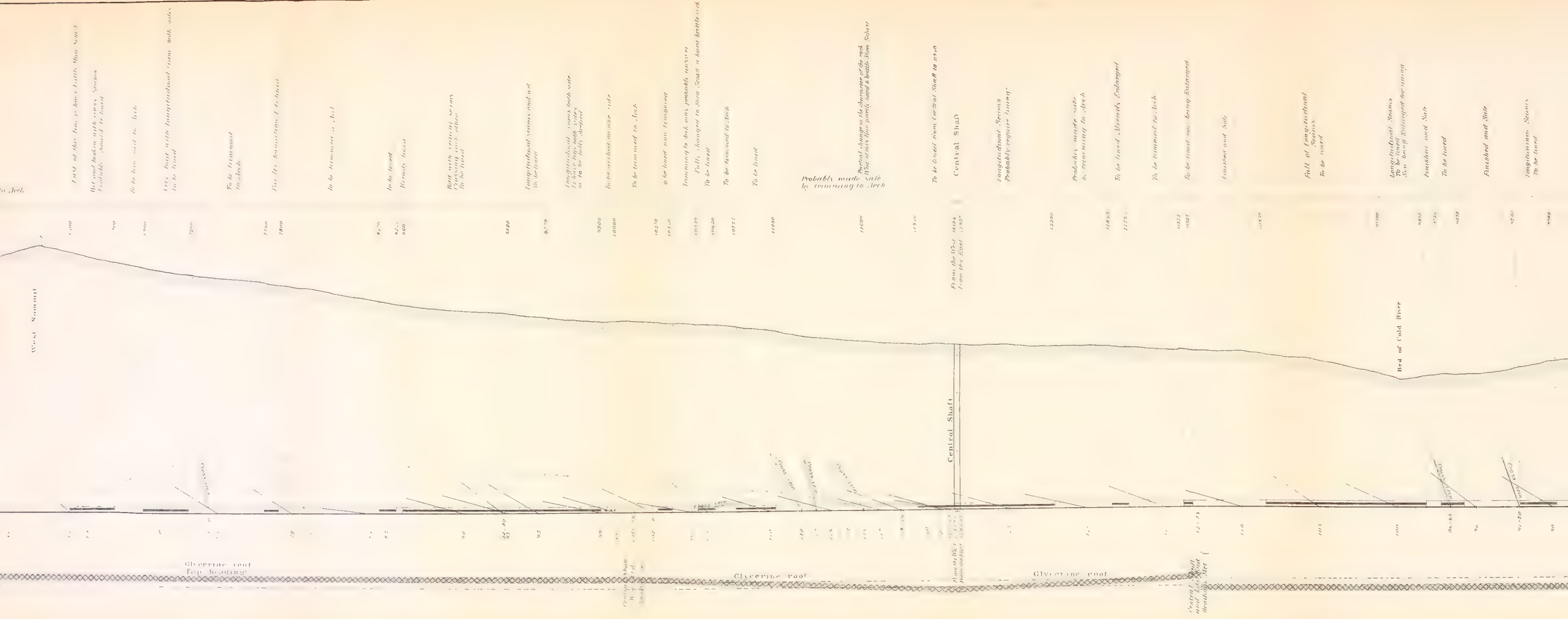


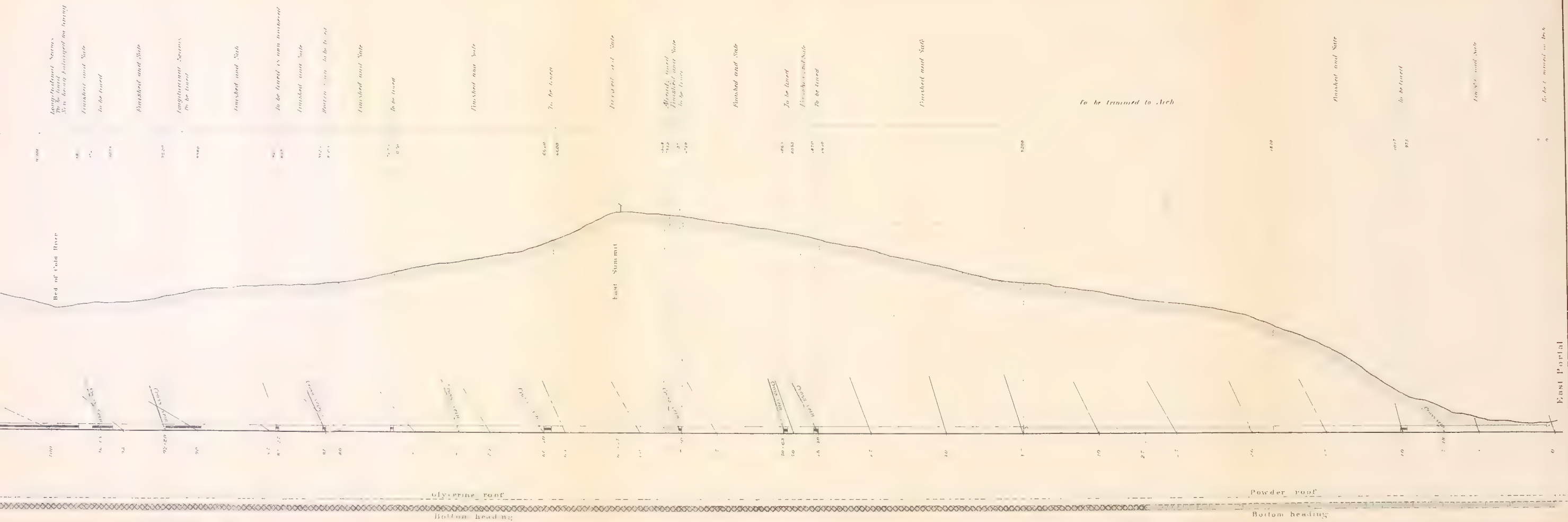
## POSITION OF HEADINGS

Bottom Reading

Line of  
gate heading

Glycerine roof  
Top heading







REPORT OF THOMAS DOANE.

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*To the Corporators of the Boston, Hoosac Tunnel and Western Railroad Company, Hon. W. B. WASHBURN, President.*

Under your appointment, and in accordance with Senate Document of the year 1874, No. 361, section 5, I beg leave to report concerning my examinations of the Hoosac Tunnel, and my conclusions therefrom, as follows :—

On the 30th September, 1874, that portion lying between the east end and the central shaft, was examined, with the assistance of Superintendent Blue and Engineer Locke.

On the 1st October, the easterly one-half of that portion lying between the central shaft and the west shaft, was examined, in company with Superintendent Roscoe and Engineer Cole.

And on the 2d October, the westerly one-half of that portion lying between the central shaft and the west shaft was examined by the aid of Superintendent Hicks and Engineer Fisher.

The examinations were made on foot, the roof being lighted by three to four lamps carried upon a long pole, and swung from side to side, and sounded, when required, by means of an iron ram upon the end of another pole.

The Messrs. Shanly provided three additional attendants to aid in lighting and sounding the roof, and in carrying oil for the lamps.

No measurements were made by me in the Tunnel, except the fractional ones required between the engineer's stations. These stations are 100 feet apart, marked upon the walls, and

are taken to be right, the whole summing up to the entire length of the Tunnel, which is well known and established.

The observations made were located by reference to these stations.

The stationing is numbered from both ends towards the central shaft.

The easterly portal is at station 0.

The central shaft, measuring from the easterly portal, is at station . . . . .	128.37
The central shaft, measuring from the west, is at station . . . . .	121.94
The westerly portal is at station, <i>minus</i> , . . . . .	.50
The total length of the Tunnel, when done, will be the sum of these distances, . . . . .	25,081 feet.
Which is equal to . . . . .	4.7502 miles.

A graphical delineation of the Tunnel, and of the observations made, with notes upon the different parts, is herewith presented and made a part of this Report. By a reference to this, the relations and proportions of the parts to each other and to the whole, may be more clearly seen and understood than by any possible written description.

The scale of it is 500 feet to an inch, and the profile of the mountain is natural.

The following is a tabular summing up of the examinations and conclusions.

All the figures in the tables represent feet.

*East of the Central Shaft.*

FROM STATION—	TO STATION—	Finished and safe.	Roof to be trimmed to semi-circle.	To be trimmed and partly lined with brick.	To be wholly lined with brick.	Now lined with brick.
0, . . .	50, . . .	—	50	—	—	—
50, . . .	975, . . .	925	—	—	—	—
975, . . .	1,017, . . .	—	—	—	42	—
1,017, . . .	1,850, . . .	833	—	—	—	—
1,850, . . .	3,500, . . .	—	1,650	—	—	—
3,500, . . .	4,840, . . .	1,340	—	—	—	—
4,840, . . .	4,870, . . .	—	—	—	30	—
4,870, . . .	5,043, . . .	173	—	—	—	—
5,043, . . .	5,063, . . .	—	—	—	20	—
5,063, . . .	5,720, . . .	657	—	—	—	—
5,720, . . .	5,737, . . .	—	—	—	17	—
5,737, . . .	5,819, . . .	82	—	—	—	—
5,819, . . .	5,858, . . .	—	—	—	—	39
5,858, . . .	6,600, . . .	742	—	—	—	—
6,600, . . .	6,640, . . .	—	—	—	40	—
6,640, . . .	7,650, . . .	1,010	—	—	—	—
7,650, . . .	7,670, . . .	—	—	20	—	—
7,670, . . .	8,100, . . .	430	—	—	—	—
8,100, . . .	8,125, . . .	—	—	—	25	—
8,125, . . .	8,427, . . .	302	—	—	—	—
8,427, . . .	8,442, . . .	—	—	—	15	—
8,442, . . .	8,980, . . .	538	—	—	—	—
8,980, . . .	9,220, . . .	—	—	—	240	—
9,220, . . .	9,575, . . .	355	—	—	—	—
9,575, . . .	9,725, . . .	—	—	—	150	—
9,725, . . .	9,815, . . .	90	—	—	—	—
9,815, . . .	10,850, . . .	—	—	—	1,035	—
10,850, . . .	11,325, . . .	475	—	—	—	—
11,325, . . .	11,375, . . .	—	—	—	50	—
11,375, . . .	11,735, . . .	—	360	—	—	—
11,735, . . .	11,843, . . .	—	—	—	108	—
11,843, . . .	12,200, . . .	—	357	—	—	—
12,200, . . .	12,837, . . .	—	—	—	637	—
Total East End,		7,952	2,417	20	2,409	39

*West of the Central Shaft.*

FROM STATION—	TO STATION—	Finished and safe.	Roof to be trimmed to semi-circle.	To be trimmed and partly lined with brick.	To be wholly lined with brick.	Now lined with brick.
12,194, . .	11,940, . .	—	—	—	254	—
11,940, . .	11,030, . .	—	910	—	—	—
11,030, . .	10,775, . .	—	—	—	255	—
10,775, . .	10,650, . .	—	125	—	—	—
10,650, . .	10,530, . .	—	—	—	120	—
10,530, . .	10,350, . .	—	180	—	—	—
10,350, . .	10,270, . .	—	—	—	80	—
10,270, . .	10,000, . .	—	270	—	—	—
10,000, . .	9,900, . .	—	—	100	—	—
9,900, . .	8,603, . .	—	—	—	1,297	—
8,603, . .	8,554, . .	—	—	—	—	49
8,554, . .	8,450, . .	—	—	—	104	—
8,450, . .	7,800, . .	—	650	—	—	—
7,800, . .	7,700, . .	—	—	—	100	—
7,700, . .	7,200, . .	—	500	—	—	—
7,200, . .	6,900, . .	—	—	—	300	—
6,900, . .	6,700, . .	—	200	—	—	—
6,700, . .	6,400, . .	—	—	300	—	—
6,400, . .	4,305, . .	—	2,095	—	—	—
4,305, . .	4,251, . .	—	—	—	54	—
4,251, . .	4,192, . .	—	—	—	—	59
4,192, . .	4,000, . .	—	—	192	—	—
4,000, . .	3,550, . .	—	450	—	—	—
3,550, . .	3,120, . .	—	—	—	430	—
3,120, . .	2,700, . .	—	420	—	—	—
2,700, . .	2,530, . .	—	—	—	170	—
2,530, . .	2,457, . .	—	73	—	—	—
2,457, . .	2,360, . .	—	—	—	97	—
2,360, . .	—50, . .	—	—	—	—	2,410
Totals West End, .		—	5,873	592	3,261	2,518
Totals East End, .		7,952	2,417	20	2,409	39
Totals both Ends, .		7,952	8,290	612	5,670	2,557

Total now lined with brick, . . . . . 2,557  
 to be wholly lined with brick, . . . . . 5,670  
 to be trimmed to semi-circle and partly lined, . . . . . 612  
 to be trimmed to semi-circle without brick lining, . . . . . 8,290  
 finished and safe, . . . . . 7,952

Total length of Tunnel, . . . . . 25,081



The portion pronounced above as finished and safe is in process of being trimmed of its loose or shaken stone by the Messrs. Shanly, in the completion of their contract.

It is presumed that this will be all that is necessary through the 7,952 feet.

No human wisdom can determine exactly what must be done nor how much, to make the Tunnel complete, nor where to draw the precise line between safety and danger.

But if the amount of work comprehended in the above table be done; that is, if 8,290 lineal feet of roof, now too flat, be trimmed to a semi-circle; if 612 lineal feet of Tunnel, now nearly safe, be made quite so by legs of masonry or bits of arching here and there; and if 5,670 lineal feet of Tunnel be wholly lined with brick, then it will be almost certain that it will be safe, and that it will meet all the demands of a travelling people.

Perhaps very considerably less work than is anticipated above will meet these requirements, but *this can only be determined while it is being carried forward.*

As for instance, in trimming the roof, which now seems doubtful, for 8,290 feet, it may be found, before the whole of the rock is removed which is necessary to bring it to a semi-circle, that it has become so firm, and taken such a form, that its safety can no longer be doubted.

Again: in enlarging for the proposed brick masonry through the 5,670 feet, in doing which it is necessary to bring the roof to a semi-circle,—for no one would advise a flattened arch,—it may be found that the removal of the shattered rock, and the change of form of roof thus brought about will together make portions of it safe *without* masonry.

In addition to the above, the corporators desire “the making to them of any suggestions that may occur, as to any agency now in operation, or that is likely to be in operation, tending to render the said Tunnel, or any portion of it, unsafe for the passage of railroad trains.”

In accordance with the desire thus expressed, it is deemed proper to offer the following suggestions:—

*First.*—AS TO FREEZING.

If the two portals and the central shaft are left entirely open, it is to be presumed that, by reason of the strong draughts through, during the winter, the frost will reach many portions of the Tunnel, if not, indeed, the whole of it.

The brick masonry should not be exposed to freezing; for it never will be dry, but always saturated with water; and there are many portions of that which it is proposed to leave without masonry that will not bear freezing without eventually disturbing its stability. There will also be dangerous and troublesome accumulations of ice.

It will probably be necessary to arrange for a system of gates for the shaft and doors for the portals, to be operated during the winter by men in charge, having a local telegraph at their command. By these means the proper ventilation of the Tunnel in summer can also be secured.

*Secondly.*—AS TO TOP HEADINGS, AND THE USE OF NITRO-GLYCERINE THEREIN.

In prosecuting the work of building the Tunnel, between station 11274 east, and station 4055 west, a distance of 9,702 feet, the headings have been run mainly at the top. Nitro-glycerine has been used through this whole distance, and the simultaneous discharges of it have been gradually increased in quantity, till they reached the enormous amount of one hundred pounds at one firing. It cannot be doubted that these terrible explosions in the confined rock of the body of the mountain, and so near the top of the Tunnel, must have shattered the rock which forms the roof, causing some of it to fall away at the time, and leaving other portions of it insecure.

The positions of the heading through the entire Tunnel can be seen by referring to the profile.

It is necessary to consider *these facts* in determining the safety of the Tunnel.

*Thirdly.*—AS TO THE FORM OF THE TUNNEL ROOF.

The driving of the headings at the top was not favorable to a good shaped and stable roof.

It was no doubt intended that it should be finished in the

form of a *flattened* arch, the centre of it being four feet below the line of a semi-circle.

It was almost impossible, however, to do this with a *top heading*. It was run, for the sake of speed and economy, the whole width of the Tunnel at its widest part, which was 24 feet, and sometimes more. Its floor must needs be about level: the men and machines must have at the sides not less than from six to seven feet in height in which to work; and, not being able to reach more than from eight to nine feet above the floor in the middle, the consequence is a very flat roof, with a span of from 24 to 30 feet, and a rise of from 0 to three or four feet only,—by no means a form of stability.

This is another fact which must be taken into consideration, and *which will continue in force* until the form of the roof be changed to a semi-circle, or to a gothic form, or until it be lined with masonry.

Its consideration is imperative in those portions of the mountain where the lines of stratification and cleavage lie nearly level.

The interests of the State would no doubt have been better secured had all the headings been driven at the bottom of the Tunnel, and had the semi-circular form been adopted for its roof.

*Fourthly.*—AS TO INFLUENCE OF AIR UPON WALLS AND  
ROOF OF TUNNEL.

There is very little chance that the opening of the mountain to the air will have any disintegrating or decomposing effect upon the rock, provided freezing be guarded against.

There are in the mountain many soft seams, both wet and dry, containing decomposed material, and varying in thickness from almost nothing to several feet. The opening of the Tunnel will permit, and the action of air and water will cause, the mechanical emptying of many of these seams, and, eventually, if nothing be done to prevent, the loosening of some of the rock; but it is believed that all these cases are provided for in the arching proposed.

Respectfully,

THOMAS DOANE.



## SUMMARY OF REPORTS OF EXPERTS.

## EAST OF CENTRAL SHAFT.

[Central Shaft is at Station 128+37 from the East.]

STATION TO STATION.	JAMES HALL.			T. STERRY HUNT.			JOSIAH BROWN.			D. L. HARRIS.			THOS. DOANE.		
	LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.		
	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.
0 to 50, .	50	-	-	50	-	-	50	-	-	50	-	-	-	50	-
50 to 925, .	875	-	-	875	-	-	875	-	-	875	-	-	875	-	-
925 to 975, .	-	50	-	50	-	-	50	-	-	50	-	-	50	-	25
975 to 1000, .	25	-	-	25	-	-	-	-	25	-	-	-	-	-	19
1000 to 1010, .	-	-	10	-	-	10	-	-	10	-	-	-	-	-	7
1010 to 1017, .	7	-	-	7	-	-	-	-	7	-	-	-	-	-	-
1017 to 1035, .	18	-	-	18	-	-	-	-	18	-	-	-	18	-	-
1035 to 1850, .	815	-	-	815	-	-	815	-	-	815	-	-	815	-	-
1850 to 2610, .	760	-	-	760	-	-	760	-	-	760	-	-	-	760	-
2610 to 2625, .	15	-	-	15	-	-	5	-	10	15	-	-	-	15	-
2625 to 3500, .	875	-	-	875	-	-	875	-	-	875	-	-	-	875	-
3500 to 4515, .	1015	-	-	1015	-	-	1015	-	-	1015	-	-	-	1015	-
4515 to 4525, .	-	10	-	-	10	-	10	-	-	10	-	-	10	-	-
4525 to 4590, .	65	-	-	65	-	-	65	-	-	65	-	-	65	-	-
4590 to 4600, .	-	10	-	10	-	-	-	-	10	10	-	-	10	-	-
4600 to 4840, .	240	-	-	240	-	-	240	-	-	240	-	-	240	-	-
4840 to 4850, .	-	-	10	-	-	10	10	-	-	-	-	-	-	-	10
4850 to 4860, .	-	-	10	-	-	10	-	-	10	-	-	-	-	-	10
4860 to 4870, .	10	-	-	10	-	-	-	-	10	-	-	-	-	-	10
4870 to 4875, .	5	-	-	5	-	-	-	-	5	2	-	-	5	-	-



## APPENDIX.

xlvii

4875 to 5043,	168	20	—	168	20	168	20
5043 to 5063,	647	—	—	647	—	647	—
5063 to 5710,	—	—	—	10	10	10	—
5710 to 5720,	10	—	—	17	17	17	—
5720 to 5737,	17	—	—	72	72	72	—
5737 to 5809,	72	—	—	10	10	10	—
5809 to 5819,	10	—	—	39	39	39	—
5819 to 5858,	—	—	—	522	522	522	—
5858 to 6380,	522	—	—	20	20	20	—
6380 to 6400,	20	—	—	200	200	200	—
6400 to 6600,	200	—	—	40	40	40	—
6600 to 6640,	—	40	—	670	670	670	—
6640 to 7310,	670	—	—	40	40	40	—
7310 to 7350,	—	—	—	75	75	75	—
7350 to 7425,	75	—	—	50	50	50	—
7425 to 7475,	50	—	—	165	165	165	—
7475 to 7640,	165	—	—	10	10	10	—
7640 to 7650,	10	—	—	10	10	10	—
7650 to 7660,	—	—	—	10	10	10	—
7660 to 7670,	10	—	—	10	10	10	—
7670 to 7680,	10	—	—	10	10	10	—
7680 to 7690,	—	10	—	20	20	20	—
7690 to 7710,	20	—	—	10	10	10	—
7710 to 7720,	10	—	—	280	280	280	—
7720 to 8000,	280	—	—	75	75	75	—
8000 to 8075,	75	—	—	25	25	25	—
8075 to 8100,	—	25	—	15	15	15	—
8100 to 8115,	—	15	—	10	10	10	—
8115 to 8125,	—	10	—	—	—	—	—
8125 to 8425,	—	—	—	300	300	300	—
8425 to 8440,	300	—	—	15	15	15	—

Summary of Reports of Experts—Continued.

STATION TO STATION.	JAMES HALL.			T. STERRY HUNT.			JOSIAH BROWN.			D. L. HARRIS.			THOS. DOANE.		
	LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.		
	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.
8440 to 8535,	95	—	—	95	—	95	—	—	95	95	—	—	95	—	—
8535 to 8980,	445	—	—	445	—	—	—	—	—	445	—	—	445	—	—
8980 to 9000,	20	—	—	20	—	—	—	—	—	20	—	—	—	—	20
9000 to 9050,	—	—	50	25	—	25	—	—	—	—	—	—	—	—	50
9050 to 9150,	—	—	100	100	—	100	—	—	100	—	—	—	—	—	100
9150 to 9215,	—	—	65	—	—	—	—	—	65	—	—	—	—	—	65
9215 to 9220,	—	—	—	—	—	—	—	—	5	—	—	—	—	—	5
9220 to 9250,	5	—	—	5	—	—	—	—	—	—	—	—	—	—	—
9250 to 9550,	30	—	—	30	—	—	—	—	30	30	—	—	30	—	—
9550 to 9575,	300	—	—	300	—	—	—	—	—	300	—	—	300	—	—
9575 to 9725,	25	—	—	25	—	—	—	—	25	—	—	—	25	—	—
9725 to 9800,	—	—	150	150	—	—	—	—	150	—	—	—	—	—	150
9800 to 9810,	—	75	—	—	—	—	—	—	—	—	—	—	75	—	—
9810 to 9815,	—	—	10	—	—	10	—	—	—	—	—	—	10	—	—
9815 to 10800,	—	—	5	—	—	5	—	—	—	—	—	—	5	—	—
10800 to 10850,	—	—	985	—	—	985	—	—	985	—	—	—	—	—	985
10850 to 10900,	—	50	—	—	—	50	—	—	50	—	—	—	—	—	50
10900 to 11300,	—	50	—	—	—	50	—	—	50	—	—	—	50	—	—
11300 to 11325,	—	—	400	—	—	400	—	—	400	400	—	—	400	—	—
11325 to 11375,	—	—	25	—	—	25	—	—	25	—	—	—	25	—	—
11375 to 11385,	—	—	50	—	—	50	—	—	50	—	—	—	—	—	50
11385 to 11450,	—	—	10	—	—	10	—	—	10	—	—	—	—	10	—
11450 to 11700,	—	—	65	—	—	—	—	—	65	—	—	—	—	—	—
	—	—	250	250	—	—	250	—	—	—	—	—	—	250	—



## Summary of Reports of Experts—Continued.

STATION TO STATION.	JAMES HALL.			T. STERREY HUNT.			JOSIAH BROWN.			D. L. HARRIS.			THOS. DOANE.		
	LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.		
	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.
11300 to 11280,	-	-	20	20	-	-	-	-	20	-	-	20	-	20	-
11280 to 11250,	-	-	30	-	30	-	-	-	30	-	-	30	-	30	-
11250 to 11050,	-	-	200	200	-	-	-	-	200	-	-	200	-	200	-
11050 to 11030,	-	-	20	-	20	-	-	-	20	-	-	20	-	20	-
11030 to 10775,	-	-	255	-	255	-	-	-	255	-	-	255	-	-	255
10775 to 10650,	-	-	125	-	125	-	-	-	125	-	-	125	-	125	-
10650 to 10530,	-	-	120	-	120	-	-	-	120	-	-	120	-	-	120
10530 to 10525,	-	-	5	-	5	-	-	-	5	-	-	5	-	5	-
10525 to 10350,	-	-	175	175	-	-	-	-	175	-	-	175	-	175	-
10350 to 10335,	-	-	15	15	-	-	-	-	15	-	-	15	-	-	15
10335 to 10270,	-	-	65	-	-	65	-	-	65	-	-	65	-	-	65
10270 to 10260,	-	-	10	-	10	-	-	-	10	-	-	10	-	10	-
10260 to 10250,	-	-	10	10	-	-	-	-	10	-	-	10	-	10	-
10250 to 10150,	-	-	100	100	-	-	100	-	-	-	-	100	-	100	-
10150 to 10000,	-	150	-	150	-	-	150	-	-	-	-	150	-	150	-
10000 to 9750,	-	250	-	250	-	-	-	-	250	-	-	250	-	-	250
9750 to 9650,	-	100	-	100	-	-	100	-	-	-	-	100	-	-	100
9650 to 9600,	-	50	-	50	-	-	-	-	50	-	-	50	-	-	50
9600 to 9500,	-	-	100	100	-	-	-	-	100	-	-	100	-	-	100
9500 to 9420,	-	-	80	-	80	-	-	-	80	-	-	80	-	-	80
9420 to 9400,	-	-	20	-	20	-	20	-	-	-	-	20	-	-	20
9400 to 9350,	-	50	-	50	-	-	-	-	50	-	-	50	-	-	50
9350 to 9300,	-	50	-	50	-	-	50	-	-	-	-	50	-	-	50



## APPENDIX.

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9300 to	9210,	90	10	100	50	20	50	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30
9210 to	9200,	10	100	50	20	50	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30	
9200 to	9100,	100	50	20	50	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30		
9100 to	9050,	50	20	50	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30			
9050 to	9030,	20	50	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30				
9030 to	8980,	50	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30					
8980 to	8950,	30	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30						
8950 to	8900,	150	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30							
8900 to	8800,	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30								
8800 to	8780,	20	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30							
8780 to	8700,	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30								
8700 to	8603,	80	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30								
8603 to	8594,	97	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30									
8594 to	8556,	9	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30										
8556 to	8554,	38	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30											
8554 to	8525,	2	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30												
8525 to	8500,	29	25	40	10	450	180	300	100	100	200	25	75	200	20	30													
8500 to	8460,	25	40	10	450	180	300	100	100	200	25	75	200	20	30														
8460 to	8450,	40	10	450	180	300	100	100	200	25	75	200	20	30															
8450 to	8000,	10	450	180	300	100	100	200	25	75	200	20	30																
8000 to	7980,	450	180	300	100	100	200	25	75	200	20	30																	
7980 to	7800,	20	180	300	100	100	200	25	75	200	20	30																	
7800 to	7700,	180	300	100	100	200	25	75	200	20	30																		
7700 to	7400,	100	100	100	200	25	75	200	20	30																			
7400 to	7300,	300	100	100	200	25	75	200	20	30																			
7300 to	7200,	100	100	200	25	75	200	20	30																				
7200 to	7000,	100	200	25	75	200	20	30																					
7000 to	6975,	200	25	75	200	20	30																						
6975 to	6900,	25	75	200	20	30																							
6900 to	6700,	75	200	20	30																								
6700 to	6680,	200	20	30																									
6680 to	6650,	200	20	30																									

## Summary of Reports of Experts—Concluded.

STATION TO STATION.	JAMES HALL.			T. STERRY HUNT.			JOSIAH BROWN.			D. L. HARRIS.			THOS. DOANE.		
	LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.			LINEAL FEET.		
	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.	Safe.	Trim.	Arch.
6650 to 6400, .	-	-	250	-	-	250	-	-	250	-	-	250	-	-	250
6400 to 6390, .	10	-	10	-	-	10	10	-	10	-	-	10	-	10	-
6390 to 6310, .	80	-	-	-	-	-	80	-	-	-	-	80	-	80	-
6310 to 4620, .	1690	-	-	-	-	-	1690	-	-	1690	-	-	-	1690	-
4620 to 4575, .	-	-	45	-	-	45	45	-	-	45	-	-	-	45	-
4575 to 4510, .	-	-	65	-	-	65	-	-	65	65	-	-	-	65	-
4510 to 4400, .	-	110	-	-	-	110	-	-	110	110	-	-	-	110	-
4400 to 4365, .	-	35	-	-	-	-	35	-	-	35	-	-	-	35	-
4365 to 4350, .	-	15	-	-	-	-	15	-	-	-	-	15	-	15	-
4350 to 4325, .	-	25	-	-	-	-	-	-	25	-	-	25	-	25	-
4325 to 4305, .	-	-	20	-	-	20	-	-	20	-	-	20	-	20	-
4305 to 4251, .	-	54	-	-	-	54	-	-	54	-	-	54	-	-	54
4251 to 4192, .	-	59	-	-	-	1	58	-	1	59	-	-	59	-	-
4192 to 4180, .	-	-	12	-	-	-	12	-	-	-	-	12	-	-	12
4180 to 4100, .	-	-	80	-	-	-	-	-	80	-	-	80	-	-	80
4100 to 4050, .	-	-	192	-	-	50	-	-	50	-	-	50	-	-	50
4050 to 4000, .	-	-	-	-	-	-	-	-	50	-	-	50	-	-	50
4000 to 3975, .	25	-	-	-	-	-	-	-	-	-	-	-	-	25	-
3975 to 3550, .	405	-	-	-	-	-	425	-	25	-	-	425	-	425	-
3550 to 3500, .	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-
3500 to 3120, .	-	-	50	-	-	-	50	-	-	-	-	50	-	-	50
3120 to 2800, .	-	-	380	-	-	380	-	-	380	-	-	380	-	-	380
2800 to 2753, .	-	90	230	-	-	320	-	-	320	-	-	320	-	320	-
	-	47	47	-	-	47	-	-	47	-	-	47	-	47	-

[illegible]

**\*\* Already lined.**

*Table showing the Number of identical Lineal Feet of the Tunnel  
that all five Experts agree to be safe.*

## EAST OF THE CENTRAL SHAFT.

STATION TO STATION.	Lineal Feet.	STATION TO STATION.	Lineal Feet.
50 to 925, . . .	875	6640 to 7310, . . .	670
1035 to 1850, . . .	815	7350 to 7425, . . .	75
3500 to 4515, . . .	1015	7475 to 7640, . . .	165
4525 to 4590, . . .	65	7670 to 7680, . . .	10
4600 to 4840, . . .	240	7690 to 7710, . . .	20
4870 to 5043, . . .	170	7720 to 8000, . . .	280
5063 to 5710, . . .	647	8125 to 8425, . . .	300
5737 to 5809, . . .	72	8535 to 8980, . . .	445
5858 to 6380, . . .	522	9250 to 9550, . . .	300
6400 to 6600, . . .	200	East of Central Shaft,	6886

## WEST OF THE CENTRAL SHAFT.

12194 to 2360, . . .	None.	2360 to — 50, . . .	*
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\* Already lined.



*Table showing the Number of identical Lineal Feet of the Tunnel that all five Experts agree must be arched with brick.*

## EAST OF THE CENTRAL SHAFT.

STATION TO STATION.	Lineal Feet.	STATION TO STATION.	Lineal Feet.
1000 to 1010, . . .	10	10800 to 10850, . . .	50
4850 to 4860, . . .	10	11325 to 11375, . . .	50
5043 to 5063, . . .	20	11735 to 11825, . . .	90
8100 to 8115, . . .	15	12350 to 12650, . . .	300
8425 to 8440, . . .	15	12700 to 12764, . . .	64
9050 to 9150, . . .	100	East of Central Shaft,	1709
9815 to 10800, . . .	985		

## WEST OF THE CENTRAL SHAFT.

12000 to 11950, . . .	50	4305 to 4251, . . .	54
11900 to 11750, . . .	50	4100 to 4050, . . .	50
10335 to 10270, . . .	65	3500 to 3120, . . .	380
9210 to 9200, . . .	10	2700 to 2530, . . .	170
9100 to 9050, . . .	50	2457 to 2447, . . .	10
8700 to 8603, . . .	97	West of Central Shaft,	1466
7200 to 7000, . . .	200		
6680 to 6650, . . .	30	East of Central Shaft,	1709
6650 to 6400, . . .	250	Total, . . .	3175

*Table showing the Number of identical Lineal Feet of the Tunnel that any three or more Experts agree to be safe.*

EAST OF CENTRAL SHAFT.

STATION TO STATION.	Lineal Feet.	STATION TO STATION.	Lineal Feet.
0 to 975, . . .	975	8125 to 8425, . . .	300
1017 to 4840, . . .	3823	8440 to 9000, . . .	560
4870 to 5043, . . .	173	9220 to 9575, . . .	355
5063 to 6600, . . .	1537	9725 to 9800, . . .	75
6640 to 7650, . . .	1010	East of Central Shaft, .	9248
7660 to 8100, . . .	440		

WEST OF CENTRAL SHAFT.

8600 to 8554, . . .	46	3975 to 3550, . . .	405
7700 to 7400, . . .	300	2447 to — 50, . . .	2497*
6975 to 6700, . . .	275	West of Central Shaft, .	5396
6390 to 4575, . . .	1815	East of Central Shaft, .	9248
4250 to 4192, . . .	58	Total, . . .	14644

\* Already lined.

*Table showing the Number of identical Lineal Feet of the Tunnel that three or more Experts agree must be lined with brick.*

## EAST OF THE CENTRAL SHAFT.

STATION TO STATION.	Lineal Feet	STATION TO STATION.	Lineal Feet.
975 to 1017, . . .	42	9000 to 9220, . .	220
4840 to 4870, . . .	30	9575 to 9725, . .	150
5043 to 5063, . . .	20	9800 to 11450, . .	1650
6600 to 6640, . . .	40	11700 to 11850, . .	150
7650 to 7660, . . .	10	11950 to 12000, . .	50
8100 to 8125, . . .	25	12200 to 12837, . .	637
8425 to 8440, . . .	15	East of Central Shaft, .	3039

## WEST OF THE CENTRAL SHAFT.

12194 to 10250, . . .	1944	4350 to 4251, . . .	99
10000 to 8603, . . .	1397	4192 to 4000, . . .	192
8554 to 8450, . . .	104	3550 to 2750, . . .	800
8000 to 7980, . . .	20	2700 to 2447, . . .	253
7800 to 7700, . . .	100	West of Central Shaft, .	5534
7400 to 7300, . . .	100	East of Central Shaft, .	3039
7200 to 6975, . . .	225	Total, . . .	8573
6700 to 6400, . . .	300		

## EXPLANATION OF THE PROFILE.

The accompanying profile will show at a glance the summary of each expert's report. Each expert is given a line and on it his notes are plotted. In the reports of the experts, where the location of each particular portion of the Tunnel is not made by stations, the lengths designated have been given, and the location, for purposes of comparison, has been made the same as that of the majority of the other experts. Where the location has been given, but no length mentioned, the length designated by the majority of the others has been taken.

The stations are numbered from the east and from the west towards the central shaft, the station of that point being  $128+37$ , or 12,837 feet from the east portal, and  $121+94$ , or 12,194 feet from the west portal.



## REPORT OF EDWARD S. PHILBRICK,

CONSULTING ENGINEER,

*Made to the Governor and Council, July 31, 1874,*

CONCERNING "HOW MUCH ARCHING WILL BE NECESSARY."

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After carefully inspecting the whole length of the Hoosac Tunnel with Mr. B. D. Frost, my opinion is, that in addition to the amount included in the Shanly contract, as recognized by the Messrs. Shanly, and now under progress, there will be certainly required, for the safe passage of trains, a further amount of 1,600 feet of arching; while, for reasons given below, there is a still further length of 3,550 feet, concerning which I cannot now form a definite opinion. In regard to this, I can only say that it should be the subject of careful treatment and watching. The chances are that a large part of it—say upwards of one-third, and perhaps two-thirds—will also require to be arched, after other expedients shall have been tried and have failed. The nature of this doubt, and the proper means of removing it, will be better understood by my explaining the structure and condition of the rock, and the natural forces tending to its disintegration.

The arched lining is now either complete or in progress from the west portal to the west shaft, say half a mile, and the portion referred to in this Report will therefore extend from the east portal to the west shaft, about  $4\frac{1}{4}$  miles.

Two causes contribute to this doubt; the unfinished condition of the contractor's work upon the roof, and the continual changes in the character of the rock in certain places, after its exposure.

*First*—as to the unfinished condition. While there remain only about 100 feet in length where any considerable enlargement is yet to be made, viz., directly east of the west shaft, there are scarcely six consecutive rods in length, through the whole work east of this point, where the roof is as yet stripped of its loose scales and masses that were shat-

tered by the blasting. A very thorough and minute examination has recently been made by Mr. Frost and his assistants, of every part of the roof, accumulating a mass of records of great value for present and future guidance. This has been done by men on ladders or horses, moved along step by step, and by sounding the roof with light, long-handled hammers, while lighted by lamps held on long poles from the floor. This may seem to be a superficial test, but a good deal of this work has been done in my presence, and I am satisfied that it is the readiest and most reliable guide as a preliminary step; *i. e.*, I am satisfied that no mass or scale of rock, of the quality here existing, which would give a hollow sound to the hammer, would be safe to work under for any length of time; while any mass that yields a clear ring, and from which the hammer rebounds with vigor, is substantially safe for the present. A single examination of this kind has shown the general presence of loose material, as above stated. In many places, the scales seem thin, and are flanked by sound rock, while the appearance and structure of the mass is such as to justify the opinion that, after stripping such scales, we may find a self-supporting roof. This applies to a total length of about 17,000 feet in detached sections. In other places, the lack of soundness in the structure (*i. e.*, physical character) of the rock, or a more general degree of hollowness under the hammer, or both these conditions combined, lead us to doubt the possibility of attaining a permanently sound roof with any reasonable amount of stripping, while, so long as such a possibility exists, we should try such expedients as seem most likely to succeed. This applies to a total length of doubtful roof, referred to above, of 3,550 feet, in detached sections.

*Second*—The deterioration in the structure of the rock is mentioned as a element of doubt in deciding how far arching may be required. The rock, through the whole distance under consideration, is a compact mica-schist, presenting a considerable variety of structure, though by no means a *soft* rock anywhere. Its weakness arises from the veins of talc and feldspar which intersect it at intervals, and the numerous seams or joints, mostly west of the central shaft, cutting the mass into detached blocks, having little or no cohesion with

one another, and carrying large quantities of water, which percolates from the surface of the mountain. The solvent power of water, acting on the sides of the crevices through which it percolates, is an important agent of change, for there are but few known minerals absolutely insoluble in water to some extent, and however small the quantity so dissolved by any one drop or gallon, the flow of water is perennial, being ever renewed by the rainfall at the surface. Although the percolating water may be supposed to become saturated with the minerals through which it passes long before arriving at the Tunnel-roof, the exposure to the air and acid gases there present may give it new solvent powers by which it is constantly working upon the very strata with which we have to deal; viz., those forming the roof of the Tunnel itself.

I have spoken of talc as a source of trouble. Where it occurs in large masses, as it did for the first thousand feet at the west end of the Tunnel, its rapid decomposition upon exposure has become familiar to all who had to do with the earlier stages of the work. But talc also occurs through the whole Tunnel, in veins varying in thickness from an impalpable film to twenty or thirty feet. These latter must, of course, be arched, having been timbered up at once on their exposure. The veins of intermediate thickness sometimes discharge their contents into the Tunnel, so that a fishing-rod can be run up for twenty feet above the roof where the crack is but two inches wide. Little inconvenience might result from this if such veins were detached and parallel, as they generally are in the eastern section, where they are found dipping eastward, with a strike nearly at right angles to the axis of the Tunnel.

They are here normal to the foliated structure of the schist, which is quite pronounced and uniform. But under the principal axis of the mountain-chain, possibly an anticlinal axis of upheaval, west of the central shaft, the case is widely different. The mass of the rock is still a hard schist and very refractory, but the foliation is slightly pronounced, while the veins of talc and feldspar occur in all conceivable directions, cutting through the structure and leaving between them blocks of all sizes with but little cohesion between each other, their surfaces being lubricated by the slimy paste of the decom-



posed vein. The decomposition of the veins of feldspar is rapid in many places in the Tunnel, where its pure, flesh-colored crystals have turned to kaolin and run into the ditch, while apparently similar crystals, exposed for months on the spoil-bank outside, are yet sound. Perhaps this decay inside the Tunnel may have been caused by fumes of sulphurous and nitrous acid from the burning of explosives. This will soon cease, but the coal-smoke from locomotives also contains such gases, and may keep the supply good in future.

Where the thickness of these veins is so slight as to be barely perceptible, the amount of cohesion between their sides is very uncertain. It is only by close watching and the lapse of time, after stripping, that their presence to an injurious extent can be decided upon. A careful record has been kept of all these doubtful places, and all changes carefully noted. A careful comparison with future observations will do much towards forming a reasonable opinion as to what must be done to make safe work in these parts of the Tunnel. I would here call attention to the fact that any opinions here expressed as to the probable soundness of the 17,000 feet, are based upon present light, and that it is quite impossible to predict what changes may occur hereafter through the decomposition of veins not yet apparent. But besides the doubtful places, there still remains a long list of other points where the character of the rock is manifestly unsafe, as ascertained since the enlargement, not only by repeated examinations as to its physical structure and the changes at work therein, but by the repeated falls which are on record. This makes up the length of 1,600 feet named above, where I consider arching to be clearly indispensable.

The stripping of the loose material from all those portions of the roof where arching is not considered absolutely necessary is a work of no small importance, not only for the parts thereby rendered safe, but as a necessary step in determining exactly how much can be so left without artificial support. This work is, I understand, to be begun at once. Nothing of importance has hitherto been done towards it, for lack of men and apparatus. Men are now being relieved at other points, but the apparatus may be lacking unless new stages be made. An attempt was recently made to remove the scales from



about 1,000 feet of the roof in the western section (between stations 8600 and 9600), but the work was so imperfectly done that the whole ground must be again worked over, as proved by subsequent examination. This is a work requiring no small degree of skill and thoroughness to insure success, and no small degree of caution to guard against injury to the men employed. Most of the loose material may be detached by bars or wedges, but in many places light blasting will be required. From all the information I can obtain, I think a gang of men, with a suitable carriage or stage travelling on wheels, can work over an average of 1,000 feet per month, if worked three shifts per day. There being about 20,500 feet to work over, three full triple gangs will thus require about seven months to accomplish the whole, or six full gangs may do it in three and a half months, if supplied with apparatus.

The time to be required in arching the 1,600 feet considered certainly necessary, will depend, in great measure, upon the vigor and ability of the men who undertake it. The laying of the brick and lining of the space between arch and rock will take less time than the excavation to make room for them. After consulting with Mr. Shanly, I am inclined to think that, by working three shifts, one gang can complete an average of 100 feet per month. The removal of the debris will limit the number of points of attack to four at first; and afterwards, to three and two. An average of three gangs, working three shifts, may possibly finish the 1,600 feet in five or six months, but it will be difficult to attain this.

The *form of arch* fixed upon some years since for use in the western end, was very well devised for the conditions then existing, but we have now to deal with different conditions, and I would recommend a change by which some cost may be saved, and equal security attained. The rock we now have to deal with is not likely to trouble us by lateral pressure, and I would therefore build the side walls plumb below the springing line of the arch, keeping the full width of twenty-six feet in clear to the bottom. Also, I would not deem it worth while to excavate for foundation below the rock floor or grade line. If suitable building-stone could be readily got, I should advise in this connection, the use of stone in place of brick for the lower four or five feet. Stone would be less likely to

be abraded by wear, through contact with tools and materials used in track repairs. But the cost of getting suitable stone from quarries for the purpose would exceed the cost of brick, while the stone found in the Tunnel is too shapeless and too refractory under tools, to admit of its being used with propriety. The possibility of starting the brick arch from a shoulder or offset to be cut in the rock several feet above the floor, has also engaged my attention. It is, doubtless, feasible; but the cost of making such a shoulder, which should present a surface *not sloping down* towards the centre of the Tunnel, so as to form a stable bearing, without at the same time shattering the material directly under it, on which the weight would be imposed, would, in my opinion, be greater than the cost of blasting out and beginning at the floor. If the rock wall was of a less refractory material, such as limestone or sandstone, or if horizontally stratified by nature, such a process would be comparatively cheap; but, with the materials nature has placed there, a large amount of hand-picking would be necessary to secure a sound shoulder, making the process very costly.

In view of facilitating the progress of the arching, by bringing brick, by rail, from Greenfield, I would suggest the propriety of making provision at once for a track from the end of the present tracks to the Tunnel, over the rock embankment, at the east end, and the ballasting of the same with gravel.

Respectfully submitted by,  
Your obedient servant,

EDWARD S. PHILBRICK,  
*Consulting Engineer.*

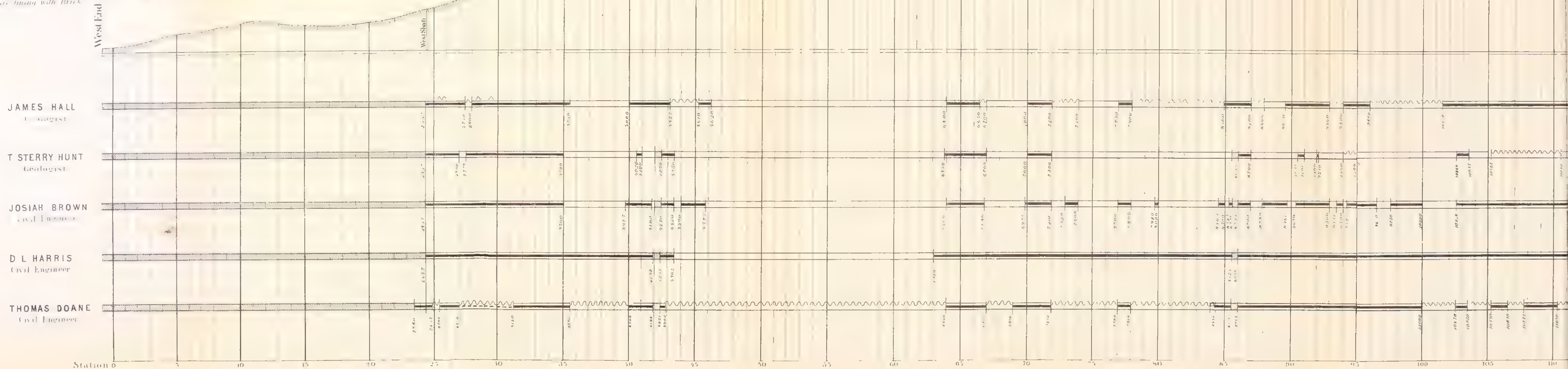


PROFILE OF HOOSAC MOUNTAIN  
made to accompany the  
**Reports of the five Experts**  
appointed to examine  
**HOOSAC TUNNEL,**

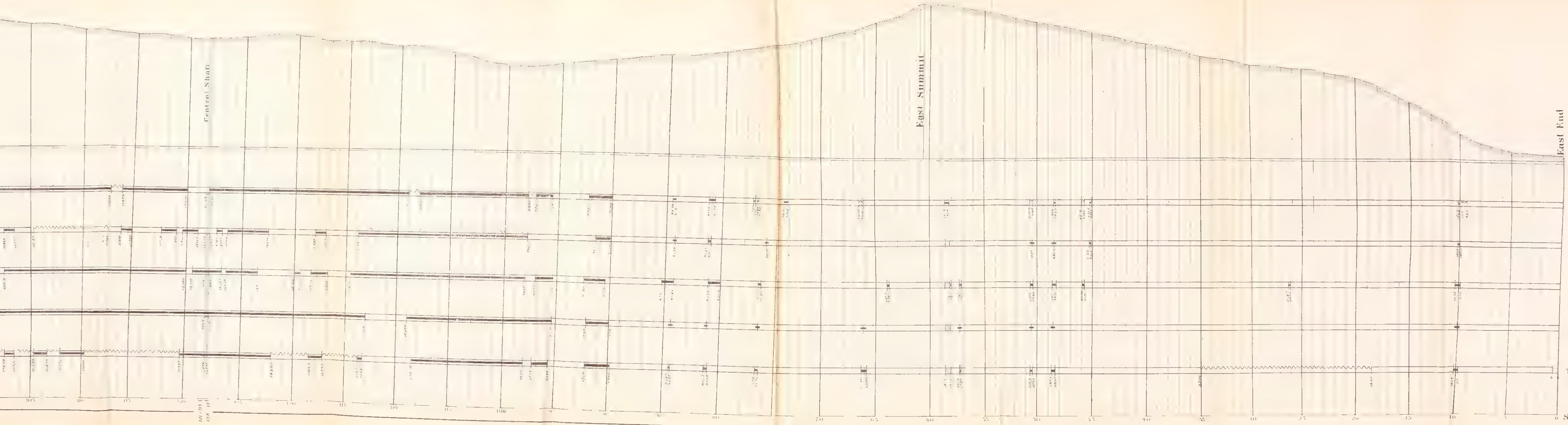
SHOWING THE  
Number of lineal feet that each decides to be  
already lined, to be finished and safe to require trimming to Arch and  
to require lining with Brick.

Explanation  
Already Lined  
Finished and Safe  
To be trimmed to Arch  
To be lined with Brick

SCALE 500 Ft TO AN INCH  
NOVEMBER, 1874







East End

JAMES HALL  
Geologist

T STERRY HUNT  
Geologist

JOSIAH BROWN  
Civil Engineer

D L HARRIS  
Civil Engineer

THOMAS DOANE  
Civil Engineer

Station

PLANTING OF WOODS IN THE

REPAIRS OF THE

HOUSE AT

THE HOUSE AT  
THE HOUSE AT  
THE HOUSE AT  
THE HOUSE AT



THE HOUSE AT

THE HOUSE AT

THE HOUSE AT

THE HOUSE AT

THE HOUSE AT

[B.]

## REPORT OF GEO. S. MORISON,

CIVIL ENGINEER,

ON THE ROUTES BETWEEN NORTH ADAMS AND POINTS IN  
THE STATE OF NEW YORK.

[REFERRED TO IN THE REPORT, Pages 17-19.]

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HON. W. B. WASHBURN, *President Boston, Hoosac Tunnel & Western Railroad Corporation.*

DEAR SIR:—In August last I was requested by Mr. Charles F. Adams, Jr., in behalf of your corporation, to make a general examination of the country west of the Hoosac Mountain, and to report upon the merits of the several routes from the Hoosac Tunnel to the Hudson River, or to a connection with the New York Central and the Albany & Susquehanna railroads, the projected routes for a line to Lake Ontario independent of any now existing, and the several lines of water communication from which your railroad might hope to derive traffic.

About the 1st of September I visited Albany and North Adams, and made a cursory examination of the country, with a view to determining what course my more careful examinations should take. On this occasion I went on foot through the Hancock valley, between Williamstown and Stephentown. I also visited Oneida County, and ascertained where the governing points on the projected extension to Lake Ontario were to be found. On my return, I sent out an assistant, who took copies of county maps and of such other records as would be of value in examining the country.

In the latter part of the same month I again visited Albany, and on this occasion, finding that the Boston, Hoosac Tunnel & Albany Railroad Company, a New York organization, under the management of Col. C. Adams Stevens, had

just begun a survey of its projected route to Petersburg, and recognizing this line as more likely to prove feasible than the more southerly lines, at Col. Stevens' request I at once placed a man in the party, who took charge of the level and whose notes enabled me to verify the results of the survey.

In the early part of October, my assistant having collected all the maps and records required, I sent out another man to work with him, and had a careful barometrical examination made of the ruling summits between the Hoosac and Hudson rivers, and between the Mohawk and the Sacandaga, in Saratoga County. This examination was made with the United States standard mercurial barometers, and was also extended to Piseco Lake and the head-waters of the Sacandaga.

Finding much doubt expressed as to the grades of the Troy & Boston railroad, I had a line of levels run from the Union Depot at Troy to the summit west of Schaghticoke. The result of these levels was to confirm the general features of the recorded profiles; the ruling grades of this line being forty feet in a mile.

About the middle of October, the necessary amount of preliminary information having been collected, I made my final visit into this country, and a more thorough personal examination. With Col. Stevens I drove over the northern part of Rensselaer County, examining not only the line proposed for his railroad, but the range of hills west of Petersburg for several miles in both directions. I also went to Schaghticoke and examined the country between there and the Hudson River, crossed the river at Stillwater and went down to Mechanicville, noting the features of country which would govern the location of a line crossing the Hudson in this neighborhood. From Mechanicville I went to Ballston, going on foot over the country between the two lines of the Rensselaer & Saratoga railroad, and thence drove across the country to Johnstown, finding the character of the country such that the features of a line through it were readily determined. From Johnstown I went by rail to Rome, and on this occasion also visited Booneville and drove about nine miles west of the town, to the neighborhood of the summit on the projected railroad line to Port Ontario. From Boone-



ville I returned as far as Trenton Falls, and in company with Mr. Stryker, of Rome, who was engaged in the survey of the Boston, Rome & Oswego railroad, I drove across Herkimer County, making a careful examination of the several summits between the two Canada creeks. At the east line of the county, I was joined by Mr. H. R. Snyder, of Johnstown, with whom I went over the western part of Fulton County, and whose general knowledge of the country, as well as his more special acquaintance with the surveys made by him for the Atlantic & Ontario railroad, were of great assistance to me. In these examinations I carried an aneroid barometer and copies of county maps, which enabled me to follow the several proposed routes, and to check roughly the notes and elevations which had been furnished me.

I have also examined the records of the surveys of the Albany, Sand Lake & Stephentown railroad line, and the survey made through the same country under the direction of Mr. Bingham of Albany; of the Williamstown & Hancock railroad line; of the Boston, Rome & Oswego railroad line, and of the survey from Salisbury, near the east line of Fulton County, north-westerly towards Booneville.

My examinations were conducted throughout with a view to determining the ruling features and governing points of the country, the local details which will come up when any of these lines are built being given comparatively small attention. It was my object to find out what could be done in the several general locations considered, rather than to review the special faults and merits of lines actually surveyed.

In the pages below are described separately the three different subjects covered by my examination, viz. :—

1. The several routes from the Hoosac Tunnel to Albany, Troy, or some other point where a connection can be made with existing railroad lines to the West.

2. The railroad lines to the West, whether now in operation or projected, which the Tunnel railroad may look to making a connection with.

3. The lines of transportation by water from which the Tunnel railroad may derive traffic.

## I. RAILROAD ROUTES WEST FROM THE HOOSAC TUNNEL.

*Character of Country.*

The country which a line built west from the Hoosac Tunnel must traverse is a rugged mountain region, with a north and south local drainage. There are three parallel ranges of hills west of the Hoosac Mountain, through which mountain the Tunnel has been bored, each range terminating on the north at the valley of the Hoosick River. The first range terminates between North Adams and Williamstown; the second range terminates at Petersburg junction, and the third range in the town of Hoosick, near Eagle Bridge station. Between the Hoosac Mountain and the first range lies the valley through which the Pittsfield & North Adams railroad is built, the summit in the valley being but a short distance north of Pittsfield. Between the first and second ranges lies what is known as the Hancock valley, which drains north and south from a summit in the northern part of the town of Hancock. Between the second and third ranges lies the valley in which the Harlem Extension railroad is built, the valley draining north and south from a summit in Berlin township; this valley and the one last described come together on the south, in the township of Stephentown and their southward drainage is into Kinderhook Creek. West of the third range of hills lies a broken country sloping towards the Hudson.

The first and second ranges are too abrupt and high to think of crossing them with a railroad line. The third range terminates on the south near the south line of Rensselaer County, where Kinderhook Creek runs around it; from opposite Stephentown north as far as North Petersburg its elevation continues at least 1,500 feet above tide-water, it then falls off somewhat and the gaps are not more than 1,000 feet high.

The valley of the Hoosick River passing around these several ranges of hills forms a natural railroad route from the Tunnel west; no line can be found out of this valley without passing over the summit from one water-shed to another. A line extended due west from the Tunnel would pass about

midway between Albany and Troy, but the Troy & Boston railroad, following the general course of the Hoosick River, is driven 16 miles north of such due west course.

Any approach to an air-line west is impossible, the second range of hills is everywhere impassable, and the third range can only be crossed south of Stephentown or north of Petersburg, the southern limit being 12 miles south of the due west course from the Tunnel and the northern limit  $8\frac{1}{2}$  miles north of such course.

### *Routes to Albany.*

Two routes have been proposed for a direct line from the Hoosac Tunnel to Albany, one passing north and one south of the impassable portion of the third range of hills.

### *Hancock and Stephentown Route.*

The first follows the Hancock valley, above described, from Williamstown to Stephentown, where it crosses the Harlem Extension railroad and thence goes across the country to Albany. It connects with the Troy & Greenfield railroad about one mile east of Williamstown, and the distance from this point of junction to Albany is 47.5 miles, making the distance from North Adams to Albany 51 miles, and from Boston to Albany 194 miles, or 7 miles less than the Boston & Albany railroad.

The Massachusetts portion of this line is covered by the Williamstown & Hancock railroad organization, of which Mr. Mills of South Williamstown is president. Two surveys have been made of the New York portion of the line, one by Mr. Robert F. Ewing, and one under the direction of Mr. Bingham, engineer of the city of Albany. The survey of the route from Williamstown to Stephentown shows a line laid in the bottom of the valley which could be very cheaply constructed; but though the valley is so level as to afford an excellent line for a highway, the summit is really 1,215 feet above tide-water, the ascent from Williamstown being 625 feet in 11 miles and the descent to Stephentown 347 feet in 6.2 miles. By keeping on the side of the valley and encountering some heavy work the grades can be averaged and reduced to about 55 feet per mile, ascending eastward. The



survey shows grades exceeding 80 feet per mile in each direction. The summit is a fixed fact, which can neither be avoided nor tunnelled.

The New York portion of the line runs across the drainage of the country, passing over a summit 1,070 feet above tide-water, 8 miles west of Stephentown, and encountering very heavy and expensive work for nearly the whole distance. The surveys show grades of 60 and 80 feet per mile, ascending eastward. The average grade would be 50 feet per mile for 22 miles, but it is not probable that a line could be found on which an average grade could be constructed. By following the valley of the Kinderhook to Chatham, the summit west of Stephentown could be avoided. This, however, would increase the distance nearly 10 miles, and make the western 20 miles of the line almost identical with that of the Boston & Albany railroad.

#### *Stevens Route.*

The second route for a direct line to Albany follows the course of the Hoosick River as far as Petersburg Junction, thereby passing around the first two ranges of parallel hills, and leaving the valley so far north that the gaps in the third range have become comparatively low.

This line has recently been surveyed by the Boston, Hoosac Tunnel & Albany Railroad Company, and is now known as the Stevens route. The summit is crossed at a point known as Potter Hill. The highest elevation on the line is 1,000 feet above tide-water; but the slope at first is rapid in both directions, and by using a tunnel 3,500 feet long the elevation is reduced to 850 feet. The ascent from Petersburg to this tunnel will be by a line on the slope of the mountain. This piece of work would require great care in the location, and would be heavy and expensive in construction. The surveys here show a grade of 70 feet per mile, ascending westward; but it is believed that by passing around the head of a ravine, sufficient distance can be obtained to reduce this grade to 60 feet, and, possibly, to less. From the tunnel the line proceeds westward towards Troy. It passes through an excellent farming country, the direction of the natural drainage is favorable, and much of this



portion of the line can be cheaply constructed. The line enters the corporation limits of the city of Troy, passing near the village of Albia, and being there over 300 feet above tide-water. It then turns southward, and fitted on the declivity of the slope towards the Hudson, descends with a grade of 40 feet per mile to a point on the east side of the Hudson near the Albany and Greenbush ferry landing, where it is proposed to cross the river on a new bridge and at an elevation of 40 feet. This line can be built with no grade exceeding 40 feet per mile, ascending eastward. The work east of the tunnel and on the four miles nearest to Albany, will be of a heavy and expensive character; elsewhere the difficulties of construction are small.

A connection can be made with the Hudson River railroad, below Greenbush, with a 40-foot grade. A direct connection with either of the present bridges could not be made without using a heavier grade.

The length of this line from Petersburg to Albany is 32 miles, making the distance from North Adams 48 miles, and from Boston 191 miles, being 3 miles shorter than the Hancock route, and 10 miles less than by the Boston & Albany railroad. Between North Adams and Albany the ascent westward is 356 feet, and the ascent eastward 1,030 feet.

There is a summit a mile north of Potter Hill, the elevation of which is only 910 feet. The old Boston stage road passes through this gap, and it is possible that it would prove the best location for a railroad. The approaches, however, are not so good as those to Potter Hill, and the summit is too broad to make tunnelling expedient.

This line to Albany has merit, but it involves an ascent of 356 feet, and, of course, an equal descent, which is entirely avoided by a line following the Hoosick valley; a circumstance of little importance to a road having only a local traffic, but a serious disadvantage to a trunk freight line.

#### *Troy & Boston Railroad.*

The route from the Hoosac Tunnel to Troy is by the Troy & Boston Railroad; distance from North Adams 48 miles,

from Boston 191 miles. Ascent westward from North Adams 111 feet; ascent eastward, 785 feet.

This road was constructed nearly twenty years ago. It follows the general course of the Hoosick River for 35 miles to a point near Schaghticoke, where the river turns northward and the railroad bears southward; ascends to the divide between the Hoosick and the Hudson River, and after attaining a summit 355 feet above tide-water, descends to the city of Troy. Its maximum grade ascending eastward is 40 feet per mile, except for a very short distance in the city. The general route of this road was well selected, but the details of the location were not so good. Too much value was evidently attached to alignment, and the road, on which no other grades were required than those corresponding to the natural fall of the river, is a line of undulating character with short grades in both directions. At least 100 feet of ascent and an equal amount of descent could have been avoided by keeping the line a little further north. The abandoned road-bed of the Albany Northern railroad, though also defective in detail, is on better ground than the Troy & Boston railroad.

The Troy & Boston railroad is a single-track line, in fair order for local traffic. Its weak point seems to be its structures, many of which are old and poor.

Both Albany and Troy are on the navigable part of the Hudson, the ebb and flow of the tide reaching the latter place. At each point the river is crossed on a drawbridge and at an absolute height no greater than that of the bridge itself.

#### *Line to Schenectady.*

The Hoosick River enters the Hudson at Stillwater, 14 miles above Troy. From North Adams to Schaghticoke, six miles from Stillwater, the fall of the river is about 420 feet, an average of 12 feet per mile of valley. Within two miles below Schaghticoke, the river falls about 200 feet. At Mechanicville, three miles below Stillwater, a creek enters the Hudson from the west.

The old Albany Northern railroad was built in the Hoosick valley from Eagle Bridge to Schaghticoke; it lay north of the

Troy & Boston railraod and nearer the river. It passed directly through the village of Schaghticoke, crossing the river twice in that immediate neighborhood, being there 289 feet above tide-water, or 81 feet lower than the corresponding point on the Troy & Boston railroad. The three miles west of Schaghticoke were a succession of very heavy cuttings and embankments, and in this distance the road descended 45 feet; it then reached the side slope of the Hudson River valley and curving southward descended into the valley and crossed the river 7 miles above Troy at an elevation of 45 feet above high-water.

Between Mechanicville and Stillwater the Hudson River is very shallow and the bottom is of solid rock, the bed being in the neighborhood of 55 feet above tide-water, and high-water mark being at least 20 feet higher.

About midway between the two villages comparatively high ground approaches the river on each side, and the river could be crossed on a deck bridge, without unreasonable expense at an elevation of 130 feet above tide-water, this crossing taking the railroad very conveniently over the Champlain Canal which lies near the west bank of the river, and is 100 feet above tide-water. The descent from the old Albany Northern grade at Schaghticoke to this bridge would be 160 feet, and the distance is a little over 6 miles, so that the descent could be accomplished with a grade of 1 in 200 or 26.4 feet per mile, which is the grade adopted in the Hoosac Tunnel, from each end to the central shaft.

The track of the Rensselaer & Saratoga railroad is 106 feet above tide-water, where it crosses the Champlain Canal at Mechanicville, and it follows up the valley of the small creek mentioned above to Ballston, with no grade exceeding 26.4 feet per mile. Five miles above Mechanicville a branch enters this creek from the south-west; the summit between this branch and the Mohawk is only 310 feet above tide-water and the descent in each direction can be accomplished with light work and very easy grades, the summit being about eleven miles from the Hudson River, and eight miles from Schenectady. By this route the distance from Schaghticoke to Schenectady will certainly not exceed 26 miles, making the total distance from North Adams to Schenectady 61 miles,



and from Boston to Schenectady 204 miles. The distance from Boston to Saratoga Springs by this route would be only 205 miles. The only necessary ascent westward is from the Hudson River to the summit near Schenectady amounting to 195 feet, and the ascent eastward from Schenectady to North Adams need be only 653 feet. By way of Albany and the "Stevens route" the ascents between Schenectady and North Adams are 677 feet westward and 1,135 feet eastward, and by way of Troy and the Troy & Boston Railroad 446 feet westward and 904 feet eastward.

This line, by way of Schaghticoke and Mechanicville, can be built with no grade exceeding 26.4 feet per mile in either direction, though, as there are nearly 2.5 continuous miles of this grade in the Tunnel, where resistances are greater than in the open air, economy of construction might be fostered, without increasing the expense of operation, by using 30-foot grades. This grade should in my opinion be rigidly adhered to as the ruling maximum eastward grade, on that portion of the Tunnel line which lies west of the Connecticut River, the capacity of a locomotive on a 30-foot grade being fully 20 per cent. more than on a 40-foot grade. The grade which it would appear most difficult to avoid is the 42-foot grade between North Adams and the Tunnel, but this can easily be reduced by building about  $2\frac{1}{2}$  miles of single-track loop-line for east-bound freight trains.

Above Eagle Bridge the valley of the Hoosick River is narrow, and it would be troublesome, though not impossible, to locate a second line in the same valley. Below Eagle Bridge the Troy & Boston railroad is too far from the river, and a much better line can be found north of it. From Schaghticoke to the crossing of the Hudson River above Mechanicville, the line must be fitted to the steep slope of the valley, and the work would be very heavy; but by following the Albany Northern grade for three miles, the heaviest part of the work would be found already done. The Hudson River at the place of crossing is not far from 800 feet wide, and the cost of a bridge would not exceed \$250,000, this amount covering the cost of a first-class double track, iron deck bridge, extending from bank to bank, and with masonry of such height as to place the base of rail



seventy-five feet above the bed of the stream. From the Hudson River to Schenectady, the work is all of light and inexpensive character.

The connection with both the New York Central railroad and the lines of the Delaware and Hudson Canal Company, could be made on the north side of the Mohawk, where abundant space is afforded for yard room, and the expense of a bridge across the Mohawk would be saved.

The number of miles of new road required to be built to complete this line, assuming the Troy & Boston railroad to be used above Eagle Bridge, would be thirty-seven.

### *Comparison of Routes.*

The distances by the three routes discussed appear from the following table:—

LOCALITY.	From Boston.	From Buffalo.	From Binghamton.	Boston to Buffalo.	Boston to Binghamton.
Albany, . . .	191	298	142	489	333
Troy, . . .	191	302	149	493	340
Schenectady, .	204	281	130	485	334

Showing a difference in favor of Schenectady of four miles over Albany, and of eight miles over Troy, to all points reached by the N. Y. C. R. R., and a difference against Schenectady of one mile in favor of Albany, and a difference in favor of Schenectady of six miles against Troy to all points reached via Binghamton and the Erie railway. The gradients and the ascents and descents, however, make a much stronger showing in favor of Schenectady than is made by the distances alone. The Schenectady line has also the advantage of escaping the tolls which are charged for crossing the bridges at Albany and Troy, and the charges of the Troy Union Railroad Company in the city of Troy, and it terminates at a point where ample space can be had in the most convenient location for yards and transfer houses. On the Albany line, there is no suitable ground for this purpose, excepting on the flats south of the city, and at Troy the only available space is on Green Island, west of the river.

The value of a terminus at a large city should not be underrated. It is, however, of much more value to a local passenger business than to a heavy freight traffic, and would be of little consequence to the through business which the Tunnel route is expected to bring into Massachusetts. But it is of the utmost importance to the economical transfer of freight from one road to another, that the junction be made at a point where large yards, with abundant side tracks and convenient access can be laid out. Freight coming through Albany and Troy is hampered by having to pass through narrow streets, and yards can be built only in out-of-the-way localities; circumstances which contrast severely with the liberal arrangements which would be perfected on the north side of the Mohawk, near Schenectady.

At Buffalo, the interchange of freight and passengers between the several railroads centering there, was formerly made in the city. Of late years, however, this course has been changed. The Erie railway purchased over two hundred acres of land at East Buffalo, outside of the city, and there established an extensive yard where freight trains are made up. The New York Central railroad has also built an East Buffalo yard, lying immediately north of that of the Erie railway, where its exchange of freight is conducted, and its trains are made up. Lately a union passenger station has been erected on these grounds, in which the passenger trains of the New York Central railroad and the Lake Shore & Michigan Southern railway make their connections.

Half a century ago it was observed that nature had marked out the neighborhood of the forty-third parallel as its chosen transportation route between the East and the West. In New York State the Mohawk valley broke through the mountain range which divided the basin of the great lakes from the Atlantic slope. East of the Hudson the valleys of the Hoosick and the Deerfield rivers prolonged the line. In western Massachusetts the valleys of these two rivers approached within five miles of each other, but between them rose the lofty barrier of the Hoosac Mountain. The Mohawk valley was early occupied by the Erie Canal, and, in later years, the Utica & Schenectady railroad, now part of the New York

Central railroad, followed the same route. In 1825 a canal line was surveyed through the Hoosick and Deerfield valleys, and a tunnel proposed through the Hoosac Mountain, but the difficulties of construction were too great, and the canal east of the Hudson was never built.

To-day, after many years' delay, the Tunnel has been completed, and the only barrier in the line of the natural valleys between the Connecticut River and the great lakes has been removed. The object of the Tunnel was to complete the line which nature had marked out, and this line was down the Hoosick valley to the Hudson. Other lines may be found, but they are of artificial character, running over elevated summits, requiring powerful machinery for their operation, and encountering west of the Tunnel obstacles of the very class which the Tunnel was built to overcome: in brief, by leaving the valley of the Hoosick River the line of nature is abandoned and the one possible low grade line between the Connecticut and the Hudson is thrown away.

The falls of the Mohawk at Cohoes and of the Hoosick at Schaghticoke are obstructions which canals must overcome with heavy lockage, but which a railroad line can overcome more easily, by crossing the Hudson at an elevation and taking advantage of the comparatively level character of the country in the south-east part of Saratoga County. By the same course the loss of distance occasioned by the bends of the Mohawk below Schenectady is avoided, and the line on which the grades are the lightest is also the most direct.

The Schenectady route has the further merit of lying north of all other lines, and so being in a position to take advantage of the business which must one day be developed in the spruce forests and the rich iron regions of north-eastern New York. The Adirondack railroad already penetrates this district, and is expected ultimately to reach Lake Ontario near the entrance to the St. Lawrence. An east and west line north of the Mohawk valley has been proposed as an independent western route in the interests of Boston. Such a line could be built at any time as a branch of the road to Schenectady, and the power to construct such a rival road might be more valuable if used as a means of forcing favorable arrangements with existing lines, than would be the ownership of the completed line.



In brief, the construction of the line striking the Mohawk at Schenectady would appear to have the strategic merit of making the Tunnel route, under all circumstances, the independent master of its surroundings.

## II. RAILROAD CONNECTIONS TO THE WEST.

### *Connections with Existing Railroads.*

The two all-rail routes to the West, which the Tunnel road can look for an immediate connection with, are by way of the New York Central railroad and of the Erie railway, the latter being reached through the Albany & Susquehanna railroad. The former, running almost directly west with a four-track line, will soon be in a condition to supply all the business which can be handled by both the Boston & Albany and Tunnel railroads. The latter, though less direct, is not so long but what it will be of great value as a competing line, and it finds its shortest route to Boston and the interior of Massachusetts by this line, it being seventy miles shorter than the route via Newburgh and the Boston, Hartford & Erie railroad. There are four focal points through one of which the New York Central and Erie railway routes to nearly every part of the West must pass. These are Buffalo, Detroit, Cincinnati and Indianapolis; and the distance from Boston to each of these points, via Schenectady and the N. Y. C. R. R. and via the Erie railway, by both routes, appears from the following tables:—

BOSTON TO—	N. Y. C. RAILR'D.	ERIE RAILWAY.	
	Via Schenectady.	Via Schenectady.	Via Newburgh.
Buffalo, . . . . .	485	542	613
Detroit, . . . . .	721	794	865
Cincinnati, . . . . .	912	983	1,052
Indianapolis, . . . . .	950	1,019	1,090



An extension of the Albany & Susquehanna railroad from Binghamton to Canton on the Northern Central railway is proposed. Such an extension will open direct communication with the great Pennsylvania railroad system and bring Pittsburg and the railways centering there into connection with the Tunnel route.

*Connection with Coal Mines.*

The Albany & Susquehanna railroad, in the hands of the Delaware & Hudson Canal Company, is used principally as a line to distribute that company's coal, the distance from Schenectady to Carbondale, where the mines are situated, by way of the cut-off from Nineveh and the Jefferson Branch of the Erie railway, being 159 miles, making the distance from Boston 363 miles.

The distance from Boston to Carbondale, via the B. H. & E. R. R. to Newburgh, the Erie railway to Honesdale, and the Delaware and Hudson Canal Company's gravity roads from that point, is 344 miles.

Besides the lines already existing, two new railways to the West have been proposed with which the Tunnel line would make connections.

*New York West Shore & Chicago Railroad.*

The first of these is the New York, West Shore & Chicago railroad, the line of which has been located from Hoboken to the International Bridge at Buffalo, following the west bank of the Hudson to Catskill, striking the Mohawk at Schenectady, following up the south bank of that river to Utica, and thence running by nearly an air-line to Buffalo, the whole line being located with no grade exceeding twenty feet per mile eastward, nor thirty feet westward. But little work has been done on this road, and its construction would not seem to be very probable. Should it ever be built, the Tunnel route could connect with it without difficulty at Schenectady. Connection could also be made at Albany, to which point the West Shore Company proposed to build a branch.

A similar line has recently been advocated as a route to Lake Ontario, by Mr. George I. Post, of Fair Haven, N. Y.

The line he proposes would follow the south bank of the Mohawk to Rome, and beyond that point be identical with the route of the Boston, Rome & Ontario railroad. The grades on this line would be nearly perfect, and it has merit.

*Independent Line North of Mohawk Valley.*

The second proposed line is a line lying north of the New York Central railroad, and extending from the Hudson River to some point on Lake Ontario. This line has been advocated especially as an independent western outlet for the Tunnel line.

It has been more or less talked of for many years. It was proposed and surveyed a quarter of a century ago, under the name of the Troy & Oswego railroad. More recently it has been revived by residents of the towns through which it runs, and organizations have been formed for its construction. The principal of them are the Boston, Rome & Oswego Railroad Company, the western terminus of which is made at North Bay, on Oneida Lake, where a connection with the New York & Oswego Midland railroad is proposed; and the Atlantic & Ontario Railroad Company, whose articles as organized go no farther west than Salisbury, near the west line of Fulton County. Hon. Calvert Comstock, of Rome, is president of the B. R. & O. R. R. Co., and I am indebted to him for much assistance in my examinations. Other organizations have been made, covering a line from Salisbury to Henderson Harbor, and from Boonville to Point Ontario, and surveys made of the routes. These surveys are generally somewhat fragmentary, though between Johnstown, Salisbury and Boonville, they appear to have been very judiciously made.

North of the Mohawk lies the elevated country which is known as the New York Wilderness. It is an uninhabited region of mountain and forest land. It has a drainage towards the east through the upper Hudson River and its tributary, the Sacondaga; a southern drainage into the Mohawk, through the Garoga and the two Canada Creeks, and a western drainage into Lake Ontario, through the Black River and its tributaries. These streams generally rise

in lakes whose elevation is 1,600 feet and upwards above tide-water. An east and west railway must either be placed so far north as to pass through the wilderness above the watershed of the southern drainage, or it must cross the several tributaries of the Mohawk, and the divides between them.

Surveys have been made on different occasions for railroad lines passing north of these southerly water-courses, and practical routes can be found for them. Any such line, however, must ascend to the high elevation where the streams head, and be placed so far north as to be unavailable as a western connection for the Tunnel line, without great loss of distance. The most southerly line of this character would pass up the Sacondaga River, cross the summit near Piseco Lake, at an elevation of about 1,640 feet, and descend westward by the upper valley of West Canada Creek. The Sacondaga River flows south-easterly from Piseco Lake, and strikes the west line of Saratoga County at Northampton, approaching there within sixteen miles of the Mohawk, its elevation being 750 feet above tide-water; it then turns a sharp angle, flows north-easterly, and enters the Hudson at Luzerne, sixteen miles due north of Saratoga Springs. The drainage of the neighboring part of Saratoga County is parallel to the course of the Sacondaga, and a direct line from Mechanicville to Northampton would be compelled to pass over ridges 1,100 and 1,200 feet above tide-water.

A line passing south of the Wilderness, and across the tributaries of the Mohawk, has been found more practicable. Such a line must pass through Saratoga, Fulton, Herkimer, and part of Oneida Counties. The place of crossing the Hudson River, suggested for the Schenectady line, would be equally favorable for this.

#### *Line through Saratoga County.*

In Saratoga County, the difficulties in the way of construction would be small. From the Hudson River to Ballston, the same creek valley would be followed which is occupied by the Rensselaer & Saratoga railroad, five miles of the line being identical with the Schenectady route. At Ballston, fourteen miles from the Hudson, the elevation of the road would be 310 feet above tide-water. From Ballston



west, the country is apparently flat, and of such character that a railroad could be constructed over it at small expense. It has, however, a steady ascending slope, and attains its full elevation about ten miles west of Ballston, and three miles east of the Fulton County line, being there about 800 feet above tide-water. A grade of fifty feet per mile, ascending westward for ten continuous miles, would be required, but the work would be light; little or no rock would be encountered, and there would be no expensive structures.

*East Part of Fulton County.*

Entering Fulton County, the general character of the surface does not change materially, but the slope of the country is southward towards the Mohawk, and the average elevation of an east and west line almost constant. It is, in brief, an inclined plateau, about twelve miles wide, sloping from the base of the high hills which are visible on the north, to the Mohawk, where it suddenly drops off into the narrow valley in which that river runs. It is more or less broken by undulations, but they are of such a character that they can be avoided by a well located line. These features continue about twelve miles. Fifteen miles from the east line of the county, the railroad would pass through Johnstown, the county-seat, and once the home of Sir William Johnson, of Mohawk Valley fame. At this point, the elevation of the railroad would be not far from 700 feet.

*West Half of Fulton County.*

Johnstown is situated on a small creek which rises a few miles farther north, and enters the Mohawk at Fonda. Ten and a half miles west of Johnstown is the Garoga Creek, and fifteen miles beyond, at the west line of the county, the East Canada Creek. Each of these streams has a very rapid fall, and the divides between them are continuations of the high country on the north, which drop off rapidly as they extend southward. By taking advantage of the rapid fall of the streams, each stream may be crossed at a higher level than the stream east of it, and by crossing the streams at an elevation above their beds, and selecting the lowest points in the ridges, the descent westward from each summit to the next



stream can be reduced to a nominal amount, and the heavy construction work can be concentrated at the creek-crossings. This has been done very successfully by Mr. H. R. Snyder, of Johnstown, under whose directions the surveys for the Atlantic & Ontario railroad were made. His line ascends westward from Johnstown, crossing the Klipse Hills six miles beyond, with a cut not over twenty feet deep, and with no descending grade, crosses the Garoga Creek, 10.5 miles from Johnstown, 85 feet above the bed of the stream. In the next 7 miles, the line ascends 266 feet, to the summit between the Garoga and the East Canada Creek, and then descends 45 feet in 8 miles to the last named creek, which it crosses at an elevation of 50 feet above the bed of the stream. I am unable to give the exact elevation of these points above tide-water. It is virtually a line with a maximum gradient of 50 feet per mile, but with all the grades in favor of the traffic.

Excepting at the crossing of the creeks the work would be light; the whole line is through a well settled farming country, and little or no rock is seen in position excepting at the crossing of the Klipse Hills mentioned above. A survey made through the same country a few miles farther north, in the interest of the Boston, Rome & Oswego railroad, encountered work of an enormously heavy and expensive character.

#### *Herkimer County.*

The portion of Herkimer County which a railroad line in this direction must cross, lies between the two Canada creeks, and the divide between these two streams is much more formidable than the more easterly divides. The high country here extends across the Mohawk River, that river breaking through the ridge at the narrow and rocky gorge at Little Falls, the ridge elsewhere maintaining a general elevation of about 1,700 feet above tide-water, the lowest points being some 300 feet lower. The country on each side of the main ridge slopes rapidly from north to south, so that the abrupt and lofty hill which marks the divide between the Canada creeks near the Mohawk, becomes a modest ridge in a rolling country twenty miles further north. The West Canada Creek, after following a south-westerly course in this elevated rolling country, descends rapidly through a narrow limestone gorge at Tren-

ton, falling in all 500 feet, from an elevation of 1,200 feet above the Falls, to one of 700 feet above tide-water, below the Falls. It then takes a south-easterly course and descends gradually to the Mohawk. The lowest summits in the divide are about 1,400 feet above tide. West of Herkimer County lies the level plateau through which the Erie Canal and New York Central railroad pass, the summit level of the canal being 427 feet above tide-water, and 182 feet above Lake Ontario. The summit, at an elevation of about 1,400 feet, is unavoidable, and from it a descent of nearly a thousand feet must be made by any railroad line to the West. If the West Canada Creek is crossed above Trenton Falls, the principal descent will be made after crossing the creek. If the crossing is below the Falls, the principal descent must be made on the broken face of the steep western slope of the divide.

The survey of the Boston, Rome & Oswego railroad, aiming at the most direct route to Rome, crossed the ridge through a summit in Fairfield township, at an elevation of 1,365 feet, 33 feet below the surface, and then, following the western face of the hill, descended with a long continuous grade of 40 feet per mile, the grade being in the opposite direction to the fall of the stream, crossed the West Canada Creek near Trenton, and the Utica & Black River railroad at Holland Patent, and thence went without difficulty to Rome. The rock which is so abundant at Little Falls is nowhere visible in the upper portion of the same ridge, but the soil is generally sand and the country occupied by dairy farms. The slope on which the line is located is broken and irregular, and though no rock is met with, the work of construction would be very expensive. The distance from the East Canada Creek to Rome, by this survey, is about 42 miles, making the entire distance from the Hudson River  $110\frac{1}{2}$  miles, or a mile and a half more from Albany than by the New York Central Railroad. A small difference, however, must be looked for on a corrected location. Any line crossing the West Canada Creek below the Falls must be in the immediate neighborhood of this one, though the details of this survey were very defective, and the cost of construction would be materially reduced by concentrating the descent in a heavy gradient where assisting power would be used in the operation of the road.

The summit which would be crossed by a line crossing the West Canada Creek above the Falls lies at the heads of the Spruce and Black Creeks, tributaries of the two Canadas, in Norway township and on the border of the Wilderness. It is five miles north of the one selected for the Rome survey, and a few feet higher, but the difference is only nominal. Between the two there is but one place at which the ridge can be crossed, and that is so near the Fairfield summit as to give virtually the same results, except that it is about 50 feet higher. The summit in Norway township is considerably below the surrounding country, and has the general features of a summit in a valley, the streams not falling rapidly in either direction. The descent of Black Creek is gradual to the West Canada, and the water in Spruce Creek falls only about 100 feet in the first five miles from the summit; but it then falls suddenly in a succession of torrents several hundred feet. An ascent from the crossing of the East Canada Creek must, therefore, be made before following a natural water-course. This can be done, requiring about six miles of careful location, on the greater part of which the work will be of heavy character, and at the sacrifice of some distance. Heavy work of the same character would be encountered in rising to the Fairfield summit. The West Canada Creek would be reached at the mouth of Black Creek, at a distance of about 24 miles from the East Canada and 4 miles above the head of the Falls.

From this point the line may be turned in several directions—either down the West Canada Creek, then by a route nearly the same as that of the Utica & Black River railroad to Holland Patent, and thence to Rome; or northward to Boonville and the Black River country; or on a course between the two, direct to Lake Ontario. On every line the descent westward must be made. The distance to Rome by this route would be a little more than by the Fairfield summit.

#### *General Features.*

The general features of the line north of the Mohawk may be briefly stated as follows:—

Distance about the same as by the Mohawk valley. A single summit to be crossed at an elevation about 1,400 above



tide-water, or 950 feet above the country around Rome and the long summit level on the Erie Canal, and from which high elevation a descent of 1,300 feet must be made to the Hudson River. The principal portion of the ascent eastward can be concentrated into a single grade, where assisting power can be used; with this exception the ruling gradients of the line can be made 30 feet per mile ascending eastward, and 50 or 55 feet westward.

When the level plateau around Rome and the summit level of the canal is reached, the low grade lines to the west are no longer confined to a single valley, and a line equal in this feature to the New York Central Railroad can be constructed without difficulty. The Lake Ontario (Shore) railroad, recently sold out under foreclosure, has been bought in the interest of the Delaware, Lackawanna & Western, and the Rome, Watertown & Ogdensburg railroads, and now, in strong ownership, is being completed from Oswego to the Niagara River. There would be no difficulty in connecting with this road by such a route as to make a through line no longer than that of the New York Central railroad.

But as a through all-rail line to the West, it would be a long time before this route, climbing nearly 1,000 feet, merely to descend again into the same valley, would prove more than a weak competitor beside the New York Central railroad, with its complete western connections, its independent freight and passenger tracks, and its almost perfect location in a valley sloping gently in the direction of the traffic.

#### *Lake Connection.*

Regarded in a less ambitious light, this line is not without merit. It runs through a prosperous country, and by passing northward through the Norway summit it can be connected with the Utica & Black River railroad, near Remsen Station, where the elevation of that railroad is about 1,200 feet, and at a distance of about 93 miles from the Hudson River. This will open a line to the Black River country and the lower ports of Lake Ontario, 25 miles shorter than the route via Schenectady and Utica, and will bring that country 38 miles nearer Boston than it is now. The only port in this neighborhood with which Boston now has direct communication is



Ogdensburg on the St. Lawrence River, which is 405 miles from Boston by the Central Vermont railroad line. By this route and the Utica & Black River railroad, Clayton, 40 miles above Ogdensburg, will be brought within 365 miles of Boston, and Sackett's Harbor, which is reputed the best harbor on Lake Ontario, will be brought within 360 miles of Boston. It should be noted, however, that by restoring the abandoned railroad from Pierrepont Manor, on the R. W. & O. railroad, Sackett's Harbor could be reached by way of Rome, with equal directness.

The completion of the Welland Canal enlargement, which is to give 12 feet of water throughout, will enable a larger class of lake vessels to enter Lake Ontario, and is expected to restore to the ports of that lake the importance which they formerly held. In connection with a line of steamers on the lakes a large business could be handled by this route, the land carriage being 130 miles less than from Buffalo. Of 13,000,000 bushels of grain transported eastward from Buffalo to New York by the Erie railway in the year ending September 30, 1874, 8,000,000 bushels were received from other railroads and 3,500,000 bushels came by lake. This indicates the value of a lake port, which is also a canal port, to a railroad line. A railroad connecting your road with the Black River country and the lower lake ports, judiciously managed and not too expensively constructed, might be made to prove a profitable investment and a valuable feeder, but the scheme is one which should not be taken up without the most careful consideration. I have seldom seen a country through which it would be easier to ruin a line by bad location, and a road built here on an independent basis, without the coöperation and good-will of other lines, would probably not only prove a failure in itself but might deprive the Tunnel route of the valuable connections from which it must for many years derive its heaviest traffic.

### III. CONNECTING LINES OF WATER COMMUNICATION.

The principal route of water communication with which the Tunnel route will make connection is the Erie Canal and its tributary, the Oswego Canal.

*Erie Canal.*

The Erie Canal extends from Lake Erie at Buffalo to the Hudson River at Albany, its total length being  $349\frac{3}{4}$  miles. It is remarkable for its long levels, the whole number of locks being only 71, of which 5, with a total lift of  $43\frac{1}{2}$  feet, are ascending eastward, and 66, with a total fall of 610 feet, are descending. Schenectady is 30 miles from Albany by the canal, and between the two points the canal has to overcome the falls of the Mohawk, which is accomplished by 22 locks, having a total fall of 130 feet.

*Oswego Canal.*

The Oswego Canal extends from Lake Ontario at Oswego to the Erie Canal at Syracuse. The length from the Lake to the junction is  $38\frac{1}{4}$  miles, and the number of locks 18, with a total lift of 157 feet. The distance from the junction to Albany by the Erie Canal is 168 miles, and the number of locks 49, of which 3, with a total lift of 27 feet, are ascending, and 46, with a total fall of 427 feet, descending, making the total distance from Lake Ontario to the Hudson River 206 miles, total number of locks 67, of which 21, with a total lift of 184 feet, are ascending.

The following table shows the canal distances, the equivalent distances being computed by counting each lock as one mile :—

	Distance.	Ascending Locks.	Lift.	Descending Locks.	Fall.	Equivalent Distance.
Lake Erie to Albany,	350	5	$43\frac{1}{2}$	66	610	421
Lake Erie to Schenectady, . . .	320	5	$43\frac{1}{2}$	44	480	369
Lake Ontario to Albany, . . . . .	206	21	184	46	427	273
Lake Ontario to Schenectady, . .	176	21	184	24	297	221

There are also two proposed lines of water communication for vessels of a larger class than the boats which navigate the Erie Canal.

*Oneida Lake Ship Canal.*

The first of these is the Oneida Lake Ship Canal. This plan contemplates the improvement of the Oswego Canal from the Lake to Phoenix, 21 miles, the construction of a canal from thence to Oneida Lake,  $13\frac{1}{2}$  miles, the navigation of Oneida Lake, 23 miles, the construction of a canal from the east end of the Lake to the Erie Canal, 6 miles, and the enlargement of the Erie Canal to Troy, 128 miles. The work is one of considerable magnitude, the estimated cost being \$25,000,000, of which nearly \$20,000,000 is for the enlargement of the Erie Canal. This distance is given by Mr. McAlpine as  $191\frac{1}{2}$  miles, with 22 locks ascending, with a total lift of 182 feet; 53 locks descending, with a total fall of 427 feet. It is virtually the Oswego Canal route, improved for larger classes of vessels.

*Caughnawaga Ship Canal.*

The second proposed line is known as the Caughnawaga Canal route.

It contemplates following the St. Lawrence River, using the canals around the Rapids to Caughnawaga at the head of the Lachine Rapids above Montreal, the construction of a canal 34 miles long from there to the Richelieu River, navigation of that river and Lake Champlain to Whitehall, the enlargement of the Champlain Canal for a distance of 25 miles, and slack-water navigation in the Hudson River to Troy. There will be  $35\frac{1}{2}$  miles of canal navigation, with 22 locks, in the St. Lawrence Canals, and  $34\frac{1}{2}$  miles, with 3 locks, in the Caughnawaga Canal; there will be 25 miles of canal navigation, with 8 locks, in the Champlain Canal, and 40 miles of slack-water navigation, with 11 locks, in the Hudson River. This makes the actual amount of canal navigation between Lake Ontario and Lake Champlain 70 miles, equivalent to 93 miles of clear canal navigation without locks; and between Lake Champlain and Troy, 65 miles of actual canal and slack-water navigation, with 19 locks, equivalent to 84 miles of clear canal navigation. The canals west of Lake Champlain are generally short, and with intervals of deep-river navigation between them; in the lake and the Richelieu River there are 134 miles of continuous free navigation.

The Caughnawaga Canal lies entirely within Canadian territory, and, if built, it must be constructed by the Canadian authorities, or at least with the approval of that government. It has long been the opinion of Montreal merchants that the effect of its construction would be to divert the trade of the St. Lawrence River, southward, from a point just above the principal city and port of the Dominion; and this anticipated diversion has not been looked upon with favor by our provincial neighbors.

Should this line be opened, the Tunnel route could derive business from it, either at Albany, at Troy, or near Mechanicville, four or five locks being avoided at the latter point. It is not probable, however, that much traffic would be received from it at either of these places. Albany and Troy are both below the entire canal navigation, and but a few miles of slack-water navigation remain below Mechanicville. The distance from Boston to the nearest point at which the Tunnel route could receive freight, from vessels navigating the Caughnawaga Canal route, would be 187 miles, about two miles being required to descend from the bridge across the Hudson to slack-water in the river. The distance from Troy to New York is only 150 miles, of the cheapest kind of navigation, and the distance from New York to Boston, by the outside route, is about 350 miles; making the total distance from Troy to Boston, by water, 500 miles; which, on the basis of the freight arrangements in use between the Erie railway and the Metropolitan line of steamers, is equivalent to 165 miles of railroad carriage, making no allowance for cost of loading.

Freight intended for foreign shipment, after coming through the canals, would pass directly down the Hudson River to New York, and sea-going vessels passing through the canal with freight destined to Boston, would find it their cheapest course to sail down the Hudson, through the Sound, and deliver their freight without breach of bulk at a Boston wharf. It is doubtful, however, whether the commerce of this route would be conducted in sea-going vessels. The difference in first cost of barges and sea-going vessels, and in the number of hands required to man them, soon wipes out the cost of transshipment when barges can be safely navigated for any considerable distance. From the head of the St. Lawrence



to Troy, the distance is 425 miles, and to New York city 575 miles, through which distances barges can be safely taken.

It is possible that large lake vessels could be economically taken through the short St. Lawrence Canals and the Caughnawaga Canal to Lake Champlain. But even if this should be done, nearly one-half of the canal navigation is south of this lake, and the ports of Lake Champlain are those from which New England could most economically receive cereals coming by this route. The distance from Boston to Whitehall, via Bellows Falls and Rutland, is 195 miles, only 4 miles more than to Troy, and only 9 miles more than to the nearest point at which slack-water on the Hudson could be reached by the Tunnel route. This 9 miles difference is obtained at the expense of the equivalent of 68 miles of canal navigation, and the 4 miles difference at the expense of the equivalent of 84 miles of canal navigation.

#### *Comparison.*

When the Caughnawaga Canal is built, the Vermont railroads may derive a good traffic from it; but the water route which the Tunnel line should look to, is that by way of Oswego. This line has been open for many years, with seven feet of water, and involves only 176 miles of canal navigation from Oswego to Schenectady, as against 135 miles of canal and slack-water navigation, and a total distance of 425 miles, from the entrance to the St. Lawrence to Troy. It is, moreover, a line which can be put in operation at once. The cost of transferring grain from large lake vessels to barges is very small, and barge lines are found the most economical mode of carriage in smooth water, where slow speed must be made. The St. Lawrence canals allow the vessels navigating Lake Ontario to pass down to the lower river; but this practice, once common, is now generally abandoned, and, for reasons of economy, grain is transferred to barges at Kingston, and in them taken down the river to Montreal. (See Report of Select Senate Committee, on Transportation Routes to the Seaboard, 43d Congress, 1st Session, page 175.) The New York canals are the property of the State, and free to all on the payment of the established tolls. A line of steamers could at any time be placed on the lakes, running in connec-

tion with a line of barges, between Oswego and Schenectady, where freight could be delivered to the trains of the Tunnel route. This line would be the one on which the Tunnel railroad would have the advantage over all the other lines into New England, both in grades and in distance; and if it were desired to open the transportation line with a large class of lake vessels before the completion of the Welland Canal enlargement, the transfer could for a time be made at Buffalo instead of at Oswego. The advantage of having equally accessible canal communication with these two lake ports is a very important one. The dimensions adopted for the locks of the improved Welland Canal are 270 feet long by 45 feet wide by 12 feet deep. On the lakes above, the size of vessels is limited only by the harbors, and the depth of water on the St. Clair flats. These generally allow the passage of vessels drawing fourteen feet, thus giving to Buffalo and the port of Lake Erie an advantage of two feet over Oswego and the ports of Lake Ontario, even after the completion of the Welland Canal enlargement.

Accompanying this report, will be found a map of the country between the Hoosac Tunnel and Lake Ontario, and two sheets of profiles.

On the map, the existing railroads are shown in black, the canals in green, and the various proposed railroad lines which are considered in this report, in red.

The first sheet of profiles gives the profile of the two lines from the Connecticut River to Schenectady, via the Boston & Albany railroad, and via the Tunnel and the proposed line near Mechanicville; also the three other lines from the Tunnel; viz., the Troy & Boston railroad, the Stevens route to Albany, and the Hancock and Stephentown route to the same point. These profiles of constructed roads have been taken from such records as were at my command, and are believed to be accurate in all governing points, though not to be trusted in too minute detail. The profiles of the unconstructed lines are partly from surveys furnished me, and partly from my own observations. They are believed to give correctly the governing points of the several lines, though a

located road would conform to them only in general features. The unconstructed lines are everywhere given in red.

On the second sheet of profiles are given the connecting lines west of the Hudson River. The profile of the New York Central railroad is taken from the State Engineer's Report of 1856, and that of the Albany and Susquehanna railroad from the records in the office of that company. The western part of the proposed line north of the Mohawk is taken from the records of the Boston, Rome and Oswego survey, kindly furnished me by Mr. Comstock, and the eastern part from observations of the governing points partly collected by myself, and partly sent me by Mr. Snyder. All governing points have been practically verified by my own examinations. The profile of the Erie Canal is taken from the State Engineer's Report. This sheet, though showing no railroad lines beyond Rome and Binghamton, really gives the distinctive features of the several lines. From Rome to Buffalo, by the New York Central railroad, the distance is 188 miles, and from Binghamton to Buffalo, by the Erie railway, 208 miles. The grades on each line are excellent, the advantage being slightly with the Erie railway.

Respectfully submitted.

GEO. S. MORISON.

BOSTON, November 27, 1874.

## DISTANCES FROM BOSTON,

*Via Hoosac Tunnel and Erie Railway and Boston & Albany Railroad and New York Central Railroad.*

DESTINATION.	Boston via Hoosac Tunnel and Erie Railway.	Per- centage.	Boston via B. & A. R. R. and N. Y. C. R. R.	Per- centage.
Buffalo, . . . . .	543	109	498	100
Detroit, via G. W. R. R., .	793	108	734	100
Chicago, via M. C. R. R., .	1,077½	105	1,018	100
Cleveland, via L. S. & M. S. R. R., . . . . .	747	109	681	100
Toledo, via L. S. & M. S. R. R.,	839	105	794	100
Chicago, via L. S. & M. S. R. R.,	1,082	104	1,037	100
Columbus, . . . . .	876	106	819	100
Cincinnati, . . . . .	983	106	925	100
Louisville, via Cincinnati, .	1,093	105	1,035	100
St. Louis, via Cincinnati, .	1,323	104	1,265	100
Indianapolis, . . . . .	1,020	105	963	100
Louisville, via Indianapolis, .	1,130	105	1,073	100
St. Louis, via Indianapolis, .	1,258	104	1,201	100
Chicago, via B. & O. Extension, . . . . .	1,077	—	—	—
Toledo, via C. S. R., . . .	820	106	773	100
Logansport, . . . . .	986	105	939	100
Peoria, . . . . .	1,158	104	1,111	100

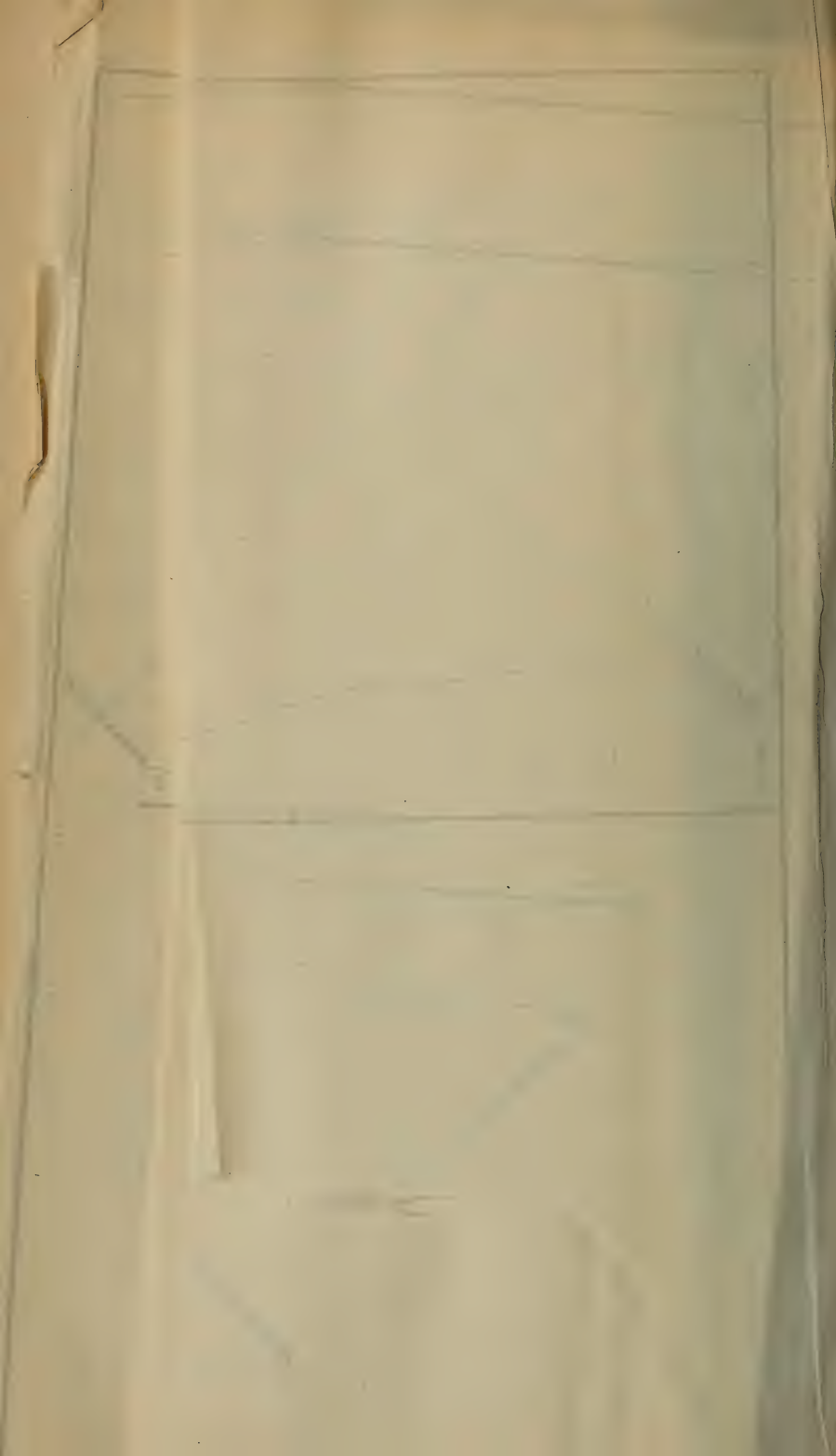


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VERMONT

MASSACHUSETTS

CONNECTICUT RIVER TO SCHENECTADY  
VIA HOOSAC TUNNEL  
Proposed Low Grade Route to Schenectady

NEW YORK

VERMONT

MASSACHUSETTS

Profiles

SHOWING -

DIFFERENT ROUTES

Between

CONNECTICUT RIVER & SCHENECTADY.

HOR SCALE 4 MILES TO 1 INCH.  
VER 400 FT

NOTE  
Connected lines shown in full line  
Proposed dotted

HOOSAC TUNNEL TO ALBANY  
VIA TROY & BOSTON & NY CENTRAL R.R.

NEW YORK

MASSACHUSETTS

HOOSAC TUNNEL TO ALBANY  
VIA POTTER HILL  
(Stevens Route)

NEW YORK

MASSACHUSETTS

HOOSAC TUNNEL TO ALBANY  
VIA HAVCOCK & STEPHENTOWN  
(Stephentown Route)

2000

1000

1000

1000

1000



## DIRECT RAILWAY CONNECTION

BETWEEN

## MASSACHUSETTS AND THE WEST.

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 ROUTES TO BE TRAVERSED, AND ADVANTAGES TO BE GAINED.
 

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[*Extracts from a paper prepared for the use of the Boston, Hoosac Tunnel & Western Railroad Company, by direction of the Pennsylvania Railroad Company.*]

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In considering the subject of direct railroad communication between New England and the Mississippi Valley, via the Hoosac Tunnel and its approaches, various contingencies present themselves that cannot, and ought not, to be lightly passed over. Between the mountains extending along her western border and the region to be reached, lie the great states of New York and Pennsylvania. These states are now interwoven with railroad lines, some of which must be made available in any new route that may be opened. It is of the utmost importance, therefore, that due consideration be given to these existing routes,—to the questions of directness, of distance, of destination they present,—but above all, to the productions and industries along the lines available, so that the largest amount of benefit may be realized by our people, and the greatest stimulant given to their industries. Taking the route via the Hoosac Tunnel as the most direct and advantageous to connect Boston, the principal city and port of New England, with the important trade-centres of the West, it will be found that three important systems of railway are now in successful operation through the states of New York and Pennsylvania, with western terminal facilities complete, any one of which can be made available. These are the lines

of the New York Central, those of the Erie, and those of the Pennsylvania Railroad Company. As to the route through Massachusetts, a glance at any railroad map will satisfy the observer that but one possesses all the advantages of directness, and available connections. This line traverses the entire length of the state, and intersects the railway system of New England,—the lines of which, as a rule, have direction north and south,—thus bringing every portion of the Eastern States in immediate connection with the line designated. The first point of direct contact with the through western lines is at Schenectady, in the State of New York, where the Central railroad is reached. The second connection is at Binghamton, where the Erie is intersected, and the third point is in the vicinity of Williamsport, in the state of Pennsylvania, where connection can be made with three of the through lines controlled by the Pennsylvania Railroad Company, viz., the Philadelphia & Erie, having outlets at Erie and Buffalo on Lake Erie, the "Low Grade," or Bennett's Branch railroad, connecting with the Allegheny Valley railroad, on the Allegheny River, and thence to Pittsburg and the north through the Oil Regions, and the Bald Eagle Valley railroad to Tyrone, through the Bituminous Coal-fields, and thence by the main line of Pennsylvania railroad, and its controlled connections, to all important points in the Mississippi Valley. For all practical purposes the gradients of these roads may be assumed as the same, because each one of them now carries, and probably always will carry, freight and passengers at as low rates per mile as its competitors.

\* \* \* \* \*

The distance from Boston to Schenectady, via the Hoosac Tunnel and its approaches, being taken as the basis for a calculation of mileage, by two of the routes to the cities of Pittsburg, Cleveland, Toledo, Chicago, Columbus, Cincinnati, Louisville, Indianapolis and St. Louis, and the distance by the Boston & Albany road being given to fairly represent the mileage of the third, the result is as follows:—

*Table of Distances from Boston via Boston & Albany Railroad and New York Central Railway and Connecting Lines.*

	Distance from Albany.	Distance from Boston.
Boston to Albany <i>via</i> Boston & Albany Railroad, 201 miles.		
Albany to Pittsburg <i>via</i> L. S. & M. S., B. C. & P.,* O. C. & A. R.* and A. V. R. Rs.,*	566	767
Albany to Cleveland <i>via</i> L. S. & M. S. R. R.,	481	682
Albany to Toledo <i>via</i> L. S. & M. S. R. R.,	594	795
Albany to Chicago <i>via</i> Gt. Western and Mich. Cent. R. Rs.,	818	1,019
Albany to Columbus <i>via</i> L. S. & M. S. and C. C. C. & I. R. Rs.,	619	820
Albany to Cincinnati <i>via</i> L. S. & M. S. and C. C. C. & I. R. Rs. and L. C. & L. R. R.,	725	926
Albany to Louisville <i>via</i> L. S. & M. S. and C. C. C. & I. R. Rs.,	835	1,036
Albany to Indianapolis <i>via</i> L. S. & M. S. and C. C. C. & I. R. Rs.,	763	964
Albany to St. Louis <i>via</i> L. S. & M. S. and C. C. C. & I., and I. & St. L. R. R.,*	1,025	1,226

\* Owned or controlled by Penn. R. R. Co.

*Table of Distances from Boston by Proposed Route and Erie Rail-  
way and Connecting Lines.*

	Distance from Binghamton.	Distance from Boston.
Boston to Schenectady by proposed route, . . . . . 202 miles.		
Schenectady to Binghamton, <i>via</i> Alb. & Susq, . . . . . 130 "		
—332 miles.		
Binghamton to Pittsburg <i>via</i> A. & G. W., O. C. & A. R. R.* and A. V. R. R.,*	434	766
Binghamton to Cleveland <i>via</i> L. S. & M. S. Ry.,	388	720
Binghamton to Toledo <i>via</i> L. S. & M. S. Ry.,	501	833
Binghamton to Chicago <i>via</i> G. W. & M. C. R. Rs.,	743	1,075
Binghamton to Columbus <i>via</i> L. S. & M. S. and C. C. C. & I. R. Rs.,	526	858
Binghamton to Cincinnati <i>via</i> Atlantic and Gt. Western Ry.,	647	979
Binghamton to Louisville <i>via</i> Atlantic & Gt. W. Ry. and L. C. & L. Ry.,	757	1,089
Binghamton to Indianapolis <i>via</i> L. S. & M. S. and C. C. C. & I. R. Rs.,	670	1,002
Binghamton to St. Louis <i>via</i> L. S. & M. S. and C. C. C. & I. and I. & St. L. Ry.,	932	1,264

\* Owned or controlled by Penn. R. R. Co.

*Table of Distances from Boston by Proposed New Route and Northern Central, Philada. & Erie, B. E. V. & Penn. R. R. and Connecting Lines.*

	Distance from Pittsburg.	Distance from Boston.
Boston to Schenectady by proposed route, . . . . .		202 miles.
Schenectady to Binghamton <i>via</i> Alb. & Susq. R. R., . . . . .		130 "
Binghamton to Ralston <i>via</i> proposed new route,* . . . . .		75 "
Ralston to Williamsport <i>via</i> N. C. Ry.,† . . . . .		24 "
Williamsport to Tyrone <i>via</i> P. & E.† and B. E. V. R. Rs.,† . . . . .		79 "
Tyrone to Pittsburg <i>via</i> Penn. R. R., . . . . .		131 "
—641 miles.		
Pittsburg to Cleveland <i>via</i> C. & P. R. R.,† . . . . .	150	791
Pittsburg to Toledo <i>via</i> P. Ft. W. & C.† and M. C. and L. M. R. Rs.,† . . . . .	261	902
Pittsburg to Chicago <i>via</i> P. Ft. W. & C. R. R.,† . . . . .	469	1,110
Pittsburg to Columbus <i>via</i> P. C. & St. L. Ry.,† . . . . .	193	834
Pittsburg to Cincinnati <i>via</i> P. C. & St. L. Ry.,† . . . . .	313	954
Pittsburg to Louisville <i>via</i> P. C. & St. L. Ry.† and L. C. & L. R. R.,† . . . . .	423	1,064
Pittsburg to Indianapolis <i>via</i> P. C. & St. L. Ry.,† . . . . .	381	1,022
Pittsburg to St. Louis <i>via</i> P. C. & St. L. Ry.† and Vandalia Line,† . . . . .	620	1,261

\* Distance estimated.

† Owned or controlled by Penn. R. R. Co.

*Table of Distances from Boston by Proposed Route and Northern Central and Philada. & Erie R. Rs. and Connecting Lines.*

	Distance from Williamsport.	Distance from Boston.
Boston to Schenectady by proposed route, . . . . .		202 miles.
Schenectady to Binghamton <i>via</i> Albany & Susq. R. R., . . . . .		130 "
Binghamton to Ralston <i>via</i> proposed new route,* . . . . .		75 "
Ralston to Williamsport <i>via</i> N. C. Ry.,† . . . . .		24 "
—431 miles.		
Williamsport to Erie <i>via</i> Phila. & Erie R. R.,† . . . . .	248	679
Williamsport to Buffalo <i>via</i> Phila. & Erie R. R.† and B., N. Y. & P. R. R. . . . .	219	650
Williamsport to Cleveland <i>via</i> Phila. & Erie R. R.† and L. S. & M. S. R. R., . . . . .	343	774
Williamsport to Toledo <i>via</i> Phila. & Erie R. R.† and L. S. & M. S. R. R., . . . . .	456	887

\* Distance estimated.

† Owned or controlled by Penn. R. R. Co.



*Table of Distances, etc.—Continued.*

	Distance from Williamsport.	Distance from Boston.
Williamsport to Chicago <i>via</i> Phila. & Erie R. R.* and L. S. & M. S. R. R.,	700	1,131
Williamsport to Columbus <i>via</i> Phila. & Erie R. R.* and L. S. & M. S. R. R. and C. C. C. & I. R. R.,	481	912
Williamsport to Cincinnati <i>via</i> Phila. & Erie R. R.* and L. S. & M. S. R. R. and C. C. C. & I. R. R.,	587	1,018
Williamsport to Louisville <i>via</i> Phila. & Erie R. R.* and L. S. & M. S. R. R. and L. C. & L. R. R.,	697	1,128
Williamsport to Indianapolis <i>via</i> Phila. & Erie R. R.* and L. S. & M. S. R. R.,	625	1,056
Williamsport to St. Louis <i>via</i> Phila. & Erie R. R.* and L. S. & M. S. R. R. and Vandalia Line,*	864	1,295

\* Owned or controlled by Penn. R. R. Co.

*Table of Distances from Boston by Proposed Route and Northern  
Central, Philada. & Erie and Low Grade Division of Allegheny  
Valley R. R. and Connecting Lines.*

	Distance from Pittsburg.	Distance from Boston.
Boston to Schenectady by proposed route, . . . . . 202 miles.		
Schenectady to Binghamton <i>via</i> Alb. & Susq. R. R., . . . . . 130 "		
Binghamton to Ralston <i>via</i> pro- posed route,* . . . . . 75 "		
Ralston to Williamsport <i>via</i> N. C. Ry.,† . . . . . 24 "		
—431 miles.		
Williamsport to Red Bank <i>via</i> L. G. Div. A. V. R. R.,† . . . . . 190 miles.		
Red Bank to Pittsburg <i>via</i> A. V. R. R.,† . . . . . 64 "		
—254 miles.		
Pittsburg to Cleveland <i>via</i> C. & P. R. R.,† . . . . .	150	835
Pittsburg to Toledo <i>via</i> P. F. W. & C.† and M. C. & L. M. R. Rs.,† . . . . .	261	946
Pittsburg to Chicago <i>via</i> P. F. W. & C. R. R.,† . . . . .	469	1,154
Pittsburg to Columbus <i>via</i> P. C. & St. L. Ry.,† . . . . .	193	878
Pittsburg to Cincinnati <i>via</i> P. C. & St. L. Ry.,† . . . . .	313	998
Pittsburg to Louisville <i>via</i> P. C. & St. L. Ry.† and L. C. & L. R. R., . . . . .	423	1,108
Pittsburg to Indianapolis <i>via</i> P. C. & St. L. R. R.,† . . . . .	381	1,066
Pittsburg to St. Louis <i>via</i> P. C. & St. L. Ry.† and Vandalia Line, . . . . .	620	1,305

\* Distance estimated.

† Owned or controlled by Penn. R. R. Co.

*Comparative Table of Distances from Boston by Proposed Route.*

DESTINATION.	Distance via N. Y. Cent. R. R. and Connecting Lines.*	Distance via Erie Railway and Connecting Lines.	Distance via Northern Central, P. & E., B. E. V. & P. R. R. and Connecting Lines.	Distance via Northern Central and Phila. & Erie R. R. and Connecting Lines.	Distance via Northern Central, P. & E., L. G. Div. A. V. R. R. and Connecting Lines.
	Miles.	Miles.	Miles.	Miles.	Miles.
Buffalo, . . .	-	-	-	650	-
Erie, . . .	-	-	-	679	-
Pittsburg, . . .	767	766	641	-	685
Cleveland, . . .	682	720	791	774	835
Toledo, . . .	795	833	902	887	946
Chicago, . . .	1,019	1,075	1,110	1,131	1,154
Columbus, . . .	820	858	834	912	878
Cincinnati, . . .	926	979	954	1,018	998
Louisville, . . .	1,036	1,089	1,064	1,128	1,108
Indianapolis, . . .	964	1,002	1,022	1,056	1,066
St. Louis, . . .	1,226	1,264	1,261	1,295	1,305

\* Distance from Boston, computed via Boston & Albany R. R. and from Albany.

\* \* \* \* \*

The most essential requirement of Massachusetts is the securing of a certain, abundant and reasonably cheap supply of coal, because this is the only fuel known that exists in quantities sufficient to meet the present and future demands of her manufactories and people. The present supply of this fuel is mainly transported from the mines where produced, to the markets where consumed, by mixed routes of rail and water. Coming principally from the anthracite fields of Pennsylvania, it is first shipped by railways to the seaboard, then carried to ports on the New England coast, and lastly transported again by railroad to the interior manufacturing towns where consumed. This process of shipment is complicated and expensive, and no inconsiderable portion of its expense is owing to the high rates charged, perhaps necessarily, over her own roads, running from the interior to the coal ports. Compelled, as these roads are, to furnish special facilities for coal transportation, and having but limited amounts to carry for short distances, and that too at irregular intervals, they charge rates ranging from four cents per ton per mile, and upwards, making the increased cost to the consumer fully one dollar per ton for every twenty

miles it is moved inland. Anthracite coal cannot, however, be relied upon as the fuel for manufactories. It is found only in a limited area of territory. It is mined at great expense. Its production and shipment are now controlled by a few large corporations, who fully understand its value, and will always prevent its sale at lower prices than they consider remunerative. In these prices are embraced interest charges on heavy capital invested in railroads, shipping, real estate, and mining operations. It is, besides, so peculiarly adapted, by its cleanliness and other properties, for household purposes, that the larger portion of the production will ultimately, and not remotely, thus be absorbed. Even in Pennsylvania, where alone anthracite coal is found in considerable quantity and of good quality, its use in mechanical industries is, to a considerable extent, being superseded by the cheaper and more abundant bituminous coals. The fuel which New England must rely upon in the future is, therefore, beyond all question, bituminous coal, and the mode and means by which that can best be secured are considerations of vital importance. A line uniting Massachusetts with the Pennsylvania railroad system will enter the great coal-field at its north-eastern limit, and will connect it, by the shortest and most direct route possible, with interior New England. This coal-field is called the Appalachian, and is of continental dimensions, being in its entirety eight hundred and seventy-five miles in length, extending through important parts of seven States, in a north-east and south-west direction, and is from thirty to eighty miles wide. The extreme north-eastern portions of this bed are in Pennsylvania, and embrace the anthracite basins, and the semi-bituminous basins, in Bradford, Lycoming, Tioga, Centre, Clearfield, Cambria, Bedford, Huntingdon, and Fulton counties, all of which are now extensively mined and transported to eastern and northern markets. In the language of a recent recognized authority on American coals, "these semi-bituminous regions produce what may emphatically be called the manufacturing and steam-making coal from which our country derives important elements of its greatness, as a producer from the raw material of whatever is used by man." Semi-bituminous coal, as found in the regions designated, contains only eleven or twelve, and always less than eighteen



per cent. of volatile combustible matter, and not less than seventy per cent., and never more than eighty per cent., of carbon. It has a wider range in its use than any other kind of coal. For blacksmithing or iron-working purposes, it is admitted to be by far the best, being free from sulphur, and possessing qualities and properties peculiarly recommending it to that class of artisans. From the mines now worked in the counties of Pennsylvania already named, this coal is largely shipped to all eastern cities and towns, is carried into Canada, and throughout all the western states and territories, being everywhere the recognized fuel of the iron-worker. The largest demand, however, for this semi-bituminous coal, is for steam purposes, and for these its reputation is thoroughly established.

The total production of the mines in Tioga, Bradford, and Lycoming counties in 1871, was 1,299,544 tons, and fifty per cent. of this was used in locomotive engines alone. The qualities to which it is indebted for this very important market are, among others, that it burns so that steam may be quickly raised and maintained at a regular pressure. It also possesses high evaporative power, is capable of converting a large amount of water into steam with small consumption of coal, and is attended with little smoke, soot or cinder.

Ralston (which is the point of proposed junction of the new line of railroad with the Northern Central railway, controlled and operated by the Pennsylvania Railroad Company) is the location of the McIntyre coal mines, one of the most important in this semi-bituminous region.

The properties of the coal produced here are the same as already described, and the development of the district has been unusually rapid, showing the demand that exists for this excellent fuel. This region is also rich in iron ore and fire-clay, and in the near future will undoubtedly become a point of production of various articles of great general utility.

Another extremely rich and valuable coal deposit—in some respects the richest, probably, in all the bituminous region—is located on the line of the "Low Grade road," a short distance west of the Allegheny summit, and is now being extensively developed. Coal from this region will be advantageously shipped to all the markets of the East, and the construction of the proposed line of railroad would bring it, as well as many



other exhaustless deposits, fairly within the reach of New England consumers.

Thus far no reference has been made to the immense area of bituminous coal west, and in the midst, of the Allegheny Mountains. This is the largest portion of the Pennsylvania coal region, and from it is shipped all the American gas-generating coal used in the eastern portions of the United States. Altogether the coal-field of Pennsylvania extends through or is found in thirty-nine of the sixty-six counties into which the state is divided, and of these, thirty-three contain, so far as geological research or practical mining has determined, bituminous and semi-bituminous coal; and six, anthracite. The system of railroads owned, operated and controlled by the Pennsylvania Railroad Company, penetrates twenty-seven of the bituminous and semi-bituminous counties, and four of the anthracite. No eastern outlet is furnished to the most productive of the bituminous coal regions, except by the lines of this company. In 1857 the bituminous coal carried on the Pennsylvania railroad was only 247,491 tons, and in 1873 the amount reached 3,229,214 tons, showing conclusively the rapid increase in the demand for this fuel.

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Another important contingency to be considered, in connection with the proposed line of railway, is the cheap rate at which fuel for its locomotives can be obtained, thus materially lessening the cost of transportation. In 1871 the coal consumed by the Boston & Albany railroad cost the company \$8.00 per ton, while that used by the Pennsylvania railroad cost but \$1.50 per ton, showing a difference of \$6.50 per ton. It is stated that the consumption of coal on the New York Central and Hudson River railroads amounts to 750 tons per annum for each locomotive run. Taking this as an average consumption for railroads doing a heavy traffic, it will be seen that the mere item of fuel becomes an important one in railway economy, and that the saving in this respect, by roads able to draw their supply direct from the mines, must result in a very perceptible cheapening of the cost of operating,—a result that will be all the more apparent as the limited supplies of wood, now to some extent used for fuel, are exhausted. The last official statement gives the

number of locomotives owned by the railroad companies in Massachusetts at 908; and the fuel necessary to supply them for a year, would, at the price paid for coal by the Boston & Albany road, cost more than five millions of dollars.

Another important product of the region to be penetrated by the proposed railway line, is petroleum. The annual consumption of this in New England is difficult to arrive at, and is not essential to the proper consideration of the subject as it here presents itself.

That it is largely consumed for lubricating and illuminating purposes, can be inferred from the rapid decline in the production of whale oil, once such an important item in the business of the New England states, and from the fact that almost the first, if not the very first, successful efforts made to refine and prepare crude petroleum for various uses, were made at Boston. The shipments from that port to foreign markets during 1873 amounted to 2,458,356 gallons, and this notwithstanding the fact that all the advantages for such shipments were decidedly in favor of the ports south of Long Island Sound,—Boston having no direct connection with the oil-producing regions, and the trade she controlled being entirely attributable to the interest she held in the crude product at the wells, and the reputation gained by her manufacturers in utilizing it.

The largest shipments abroad of petroleum are to such ports as Havre, Marseilles, Antwerp, Bremen, Hamburg, Konigsburg, Gibraltar, and Malta, from whence it is carried into the manufacturing centres of France, Germany and Italy, to be used in various ways in the productive arts, thus demonstrating its value as an auxiliary to industries similar to those commanding a large part of the skill of the people of New England.

Petroleum production is so wonderful in its growth and its present proportions, as to legitimately command the careful attention of every business community. In 1859 the production of the Pennsylvania region did not probably exceed 3,000 barrels, while in 1872 it amounted to 6,539,000 barrels, being more than eight-ninths of the total production of the United States, and worth in its crude state about \$25,000,000. In thirteen years it grew from nothing to rank as the third

article in value exported from our shores. If the supply continues (as the best-scientific and practical knowledge asserts it will), the proportion it bears to our foreign trade cannot be materially changed, because the uses to which it is applied abroad are constantly increasing.

The oil-producing territory of the Middle States is all, so far as now known, embraced in a belt of twenty miles in width, extending from Western New York, in a line parallel with the western slope of the Allegheny Mountains, into Tennessee. The present producing spots are in area the smallest specks upon this belt, and are scattered over it in an isolated and indiscriminate manner.

Of these spots the portions embraced in four counties in Pennsylvania produce, as already stated, eight-ninths of all the oil now brought into market, while those of West Virginia and Canada produce about a half of the remaining ninth.

With this oil territory, the system of railways controlled by the Pennsylvania Railroad Company, and with which the proposed line from Massachusetts will have a most favorable and advantageous connection, is closely, and almost exclusively, blended, controlling entirely its eastern transportation. Three trunk-lines owned by this company enter the petroleum region,—one on the northern extremity, one on the southern, and one in the centre; while an auxiliary line follows the Allegheny River in its course through the well-known belt, extending its branches along the tributary creeks whose names have become famous in connection with this wonderful natural product. Connection with this system of railroads will place Boston and other New England ports in direct communication with the only largely productive oil region, giving them advantages nearly equal to New York, Philadelphia, and Baltimore for a legitimate share of this important trade, both domestic and foreign.

While New England is able now to draw her supply of lumber from the forests of Maine and Canada, and, by water communication, from Michigan and Wisconsin, yet a wise economy cannot be insensible to the advantages of a close and favorable connection with the great lumber markets on the Susquehanna River. A railroad is an avenue of local as well as through trade, and one traversing a region produc-



ing a surplus of any staple will distribute that staple to all parts where a market can be found. Naturally, therefore, the proposed line would open up many new markets for the lumber manufactured at Williamsport, Lock Haven, and other points in Pennsylvania, and would thus benefit many communities along its course, as well as increase its own profitability. The extent of this lumbering industry at the points designated is somewhat startling.

In the ten years terminating with 1872 there was handled by the Susquehanna Boom Company, at Williamsport, 8,312,013 saw-logs, representing 1,642,801,101 feet, board-measure. In the five years terminating with 1872 the amount handled by the West Branch Boom Company, at Lock Haven, amounted to 135,883,446 feet.

On the first of January, 1874, the amount of lumber in the hands of manufacturers and dealers at these two points, amounted to 172,869,351 feet of white pine; 23,333,096 feet hemlock, 63,436,100 laths, and 5,053,655 pickets.

Such aggregates as these certainly indicate a business of sufficient importance to be taken into consideration by any prudent community looking to the developement of their trade. As it is frequently asserted that the lumber supply of Pennsylvania is rapidly approaching exhaustion, it may be well to give a few statistics bearing upon this subject. In June of the present year the "National Association of Lumbermen" convened in Williamsport, and among the reports made to its president was one showing the "quantity of standing white pine, hemlock, and hard wood timber, east and west of the Allegheny Mountains, in the state of Pennsylvania."

The totals of this estimate, which was carefully prepared by experienced lumbermen, were as follows:—

Standing white pine,	. . . . .	3,600,000,000 feet.
Standing hemlock,	. . . . .	7,000,000,000 "
Standing hard-wood, fit for saw-logs,	. . . . .	4,000,000,000 "
Aggregate of all kinds,		14,600,000,000 feet.

The distance by the proposed line of road from a central point in the bituminous coal-fields of Pennsylvania, to a



TABLE OF DISTANCES FROM SCHENECTADY TO VARIOUS WESTERN POINTS, VIA NEW YORK CENTRAL RAILROAD AND ERIE RAILWAY LINES.

[PREPARED FOR USE OF BOSTON, HOOSAC TUNNEL & WESTERN RAILROAD COMPANY, BY DIRECTION OF ERIE RAILWAY COMPANY.]

DESTINATION.	ROUTE.	Distance.	ROUTE.	Distance.	ROUTE.	Distance.	ROUTE.	Distance.	ROUTE.	Distance.	ROUTE.	Distance.	N. Y. Central Railroad.	Erie Railway.	Boston, via Schenectady and N. Y. C. R. R.	Boston, via Schenectady and Erie Railway.	Boston, via B. & A. R. R. and N. Y. C. R. R.
BUFFALO,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Buffalo, .	208									280	338	485	543	498
	A. & S. R. R., Schenectady — Binghamton, .	130															
DETROIT, via G. W. R.,	N. Y. C. R. R., Schenectady — Susp. Bridge, .	287	Erie Railway, Binghamton — Susp. Bridge, .	229½	G. W. R. R., Susp. Bridge — Detroit, .	229							516	588½	721	793	734
	A. & S. R. R., Schenectady — Binghamton, .	130															
CHICAGO,	N. Y. C. R. R., Schenectady — Susp. Bridge, .	287	Erie Railway, Binghamton — Susp. Bridge, .	229½	G. W. R. R., Susp. Bridge — Detroit, .	229	M. C. R. R., Detroit — Chicago, .	284					800	872½	1,005	1,077½	1,018
	A. & S. R. R., Schenectady — Binghamton, .	130															
CLEVELAND, via L. S. & M. S. R.,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183						463	668	668	747	681	681
	A. & S. R. R., Schenectady — Binghamton, .	130															
TOLEDO, via L. S. & M. S. R.,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Buffalo, .	208	L. S. & M. S. R., Buffalo — Toledo, .	296						576	781	781	839	794	794
	A. & S. R. R., Schenectady — Binghamton, .	130															
CHICAGO, via L. S. & M. S. R.,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Buffalo, .	208	L. S. & M. S. R., Buffalo — Chicago, .	539						819	877	1,024	1,082	1,037	1,037
	A. & S. R. R., Schenectady — Binghamton, .	130															
COLUMBUS,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Columbus, .	138				601	806	806	876	819	819
	A. & S. R. R., Schenectady — Binghamton, .	130															
CINCINNATI,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Cincinnati, .	244				707	912	912	983	925	925
	A. & S. R. R., Schenectady — Binghamton, .	130															
LOUISVILLE, via Cincinnati,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Cincinnati, .	244	L. C. & L. R., Cincinnati — Louisville, .	110		817	1,022	1,022	1,093	1,035	1,035
	A. & S. R. R., Schenectady — Binghamton, .	130															
ST. LOUIS, via Cincinnati,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Cincinnati, .	244	O. & M. R., Cincinnati — St. Louis, .	340		1,047	1,232	1,232	1,323	1,265	1,265
	A. & S. R. R., Schenectady — Binghamton, .	130															
INDIANAPOLIS,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Indianapolis, .	282				745	950	950	1,020	963	963
	A. & S. R. R., Schenectady — Binghamton, .	130															
LOUISVILLE, via Indianapolis,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Indianapolis, .	282	J. M. & I. R., Indianapolis — Louisville, .	110		855	1,060	1,060	1,130	1,073	1,073
	A. & S. R. R., Schenectady — Binghamton, .	130															
ST. LOUIS, via Indianapolis,	N. Y. C. R. R., Schenectady — Buffalo, .	280	Erie Railway, Binghamton — Salamanca, .	199	L. S. & M. S. R., Buffalo — Cleveland, .	183	C. C. C. & I., Cleveland — Indianapolis, .	282	St. L. V. T. H. & I. R., Indianapolis — St. Louis, .	238		983	1,188	1,188	1,258	1,201	1,201
	A. & S. R. R., Schenectady — Binghamton, .	130															
CHICAGO, via B. & O. R. R. Extension,	A. & S. R. R., Schenectady — Binghamton, .	130	Erie Railway, Binghamton — Salamanca, .	199	A. & G. W. R. R., Salamanca — Ashland, .	252	Ashland — Chicago Junction, .	23	B. & O. R. R., Chicago Junction — Chicago, .	268		872	1,053	1,053	1,077	773	773
	N. Y. C. R. R., Schenectady — Inter'l Bridge, .	286															
TOLEDO, via C. S. R.,	A. & S. R. R., Schenectady — Binghamton, .	130	Erie Railway, Binghamton — Inter'l Bridge, .	216	C. S. R., Inter'l Bridge — Toledo, .	269						555	760	760	820	773	773
	N. Y. C. R. R., Schenectady — Inter'l Bridge, .	286															
LOGANSPORT,	A. & S. R. R., Schenectady — Binghamton, .	130	Erie Railway, Binghamton — Inter'l Bridge, .	216	C. S. R., Inter'l Bridge — Toledo, .	269	T. W. & W., Toledo — Logansport, .	166				721	926	926	986	939	939
	N. Y. C. R. R., Schenectady — Inter'l Bridge, .	286															
PEORIA,	A. & S. R. R., Schenectady — Binghamton, .	130	Erie Railway, Binghamton — Inter'l Bridge, .	216	C. S. R., Inter'l Bridge — Toledo, .	269	T. W. & W., Toledo — Logansport, .	166	P. C. & St. L. R., Logansport — State Line, .	61	T. P. & W., State Line — Peoria, .	893	1,098	1,098	1,158	1,111	1,111
	N. Y. C. R. R., Schenectady — Inter'l Bridge, .	286															





central point of distribution in Massachusetts, would be about 450 miles. Allowing the costs of transportation of coal over this route to be the same as that now charged over the Pennsylvania railroad and its branches, viz.,  $.00\frac{933}{1000}$  cent per ton per mile, this would make the freight on coal  $\$4\frac{20}{100}$  per ton; add to this the cost of bituminous coal delivered on cars at the mines, say \$1.20 per ton—a price at which contracts for any amount can now be made—and the total cost of coal delivered in Central Massachusetts, would be \$5.40 per ton.

The fair presumption is, that this price would be lowered rather than increased when the line was in practical operation, because coal can be carried for long distances at a less cost per ton per mile than for short, and the sources from which a supply for the New England market could be secured, such, for instance, as the Ralston and other well-known deposits, would be considerably nearer than the point from which the distance above given is calculated.

In presenting the summary of facts herein contained, the design has been to give only such as legitimately bore upon the interests of the New England States, and to avoid everything that savored of unfairness. If preponderance has been given to the consideration of the subject of coal supply, the reasons are, that nothing is deemed of more importance to the future of our manufacturing industries, and that the region designated holds the only fuel that can be made available for New England purposes. While, therefore, the distances from Boston to the important centres of the West may not be less by way of the Pennsylvania railroad system than by other available routes, the advantages to be gained by this connection are numerous.

All important terminal points on the Great Lakes, the Ohio and Mississippi rivers, and in the South, can be reached over direct and unbroken lines, and travel and traffic thus be more generally and advantageously accommodated than by any other route. But above all, in importance, stands the fact that this route alone can place the New England states in complete contact with a region which not only monopolizes the most essential requisite to their future prosperity, but holds in its bosom other treasures of vast importance to their industry, progress and comfort.

[C.]

## REPORT OF THOMAS DOANE,

CONSULTING ENGINEER,

ON THE WORK DONE IN THE PROCESS OF RECONSTRUCT-  
ING THE TROY & GREENFIELD RAILROAD.

[REFERRED TO IN REPORT, Page 4.]

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*To the Corporators of the Boston, Hoosac Tunnel and Western Railroad  
Company, Hon. W. B. WASHBURN, President.*

I beg leave to present the following report of what has been done under your authority in the matter of reconstructing the Troy & Greenfield railroad.

Wm. P. Granger, who is acting as chief and constructing engineer, has had charge of the active work of rebuilding, while Edwin Stratton has made the various surveys east of Bardwell's Ferry, which substantially cover the whole ground. Both of these gentlemen have reported to me informally.

The results of Mr. Stratton's work have been presented to you in detail in my report of December 19, 1874.

As therein intimated, nothing is being done in way of rebuilding this road between Greenfield and Bardwell's Ferry, except to make up results of surveys, and it awaits legislative decision as to the route to be adopted.

If the present line be substantially adhered to, it will cost to rebuild this piece of road,—

For graduation, masonry, and bridging, about . . . . .	\$365,910 00
For eight miles steel track, . . . . .	96,000 00
Total, . . . . .	<u>\$461,910 00</u>

An important item in the above cost is for a new bridge over Green River. The present bridge is not secure, and



its location will have to be changed if it is decided to reduce the very sharp curvature at that point.

The plan adopted for rebuilding this road is as follows:—

The nature of the Deerfield River valley, which is very narrow and crooked, determines the character of so much of the road as lies in it. The country cannot be forced to any great extent without excessive cost.

In House Document No. 9, 1874, Mr. Philbrick gives the following table of curvature, which covers the present line from Greenfield to the Tunnel:—

DEGREES.	Radius in Feet.	Total Curvature.	Length of Curves in Feet.
1°, . . . . .	5,730	8° 21'	1,060
2°, . . . . .	2,865	198° 28'	10,888
3°, . . . . .	1,910	430° 56'	14,267
4°, . . . . .	1,432	735° 45'	18,808
5°, . . . . .	1,146	1,000° 49'	19,762
6°, . . . . .	955	1,125° 54'	19,044
7° to 11°, . . . . .	819 to 552	486° 49'	6,071
		3,987° 02'	89,899

From this table it will be seen that the larger amounts in degrees of curvature are of 5° curves and 6° curves, while the amount above 6° is comparatively small, though covering more than a mile. It was therefore decided to reduce all the curvature to 6° curves, or less. This will retain the road in its present location very largely. Where wholly new work is required in making changes, the curves are reduced to 5°. One costly change is now being made near Bardwell's Station, which necessitates a rock and earth cut over 60 feet deep for a distance of 800 feet, and a new bridge across the Deerfield River.

Another change must be made through the village just west of the Shelburne Falls Station, which will result in considerable outlay for land damages. Still another important change is being made in alignment at a point about one (1) mile above Zoar depot.

Other than as above the alignment is not much changed, except to true up the curves and get as much straight line as

possible between those turning in reverse directions. All curves on important bridges are also being thrown out.

The masonry is being improved in quality and built in all cases sufficient for another track.

That part of the road between Bardwell's Ferry and Shelburne Falls,  $5\frac{24}{100}$  miles, is under contract to B. N. Farren, to be completed for a single track by July 1, 1875. That part between Shelburne Falls and the Tunnel is under contract to N. C. Munson, to be completed at same time and in same manner as that part let to Mr. Farren.

It is difficult to estimate closely the cost incurred by these contracts, but

For graduation, masonry, and bridging it will probably amount to about . . . . .	\$683,500 00
For 21 miles steel track, at \$12,000, . . . . .	252,000 00
Total, . . . . .	<hr/> \$935,500 00

The wooden Howe-truss double-track bridge over the Deerfield River, near the easterly end of the Tunnel, which was strained by overloading with stone and want of care, and which perhaps was rather light at first, has had a third truss added in the middle, and is otherwise undergoing thorough repair.

No estimate is made for work yet to be done in the Tunnel. It is open through, but the track is not yet laid. It is built for a double track. The road from the west portal of the Tunnel to North Adams depot is built for a double track as to graduation, masonry, and bridging, and is two miles long.

That portion of the Troy & Greenfield railroad which lies west of North Adams and extends to the Vermont State line, is 6.84 miles long, built for a single track. The maximum grade rising east is now about seventy-nine feet per mile, and rising west, forty-six feet; both for short distances near the Little Tunnel. Other than here, the maximum grade east is forty-two feet, and west twenty feet. In rebuilding, the maximum east can easily be reduced to 31.68 feet per mile, and all the grades rising west to levels.

The adopted location of the road from the great Tunnel to North Adams, involves using a 6° curve in getting into and

through the Little Tunnel. Aside from this, the sharpest curve west of North Adams is of  $3\frac{1}{2}^{\circ}$ .

#### THE LITTLE TUNNEL AT NORTH ADAMS.

This was not built for the present location, and must be very much enlarged and changed. The minimum width is twelve and one-half, and height fifteen feet.

A level grade from the North Adams depot through the Tunnel will do away with both of the heavy grades entering it, and the cut of eight feet thus made necessary in the bottom of the Tunnel will give it the necessary height.

Building the Tunnel to the  $6^{\circ}$  curve mentioned above, will make the easterly mouth of it about fifty feet wide, which is rather a dangerous width for a tunnel, and, unless the rock is very sound, may lead to an open cut. Possibly another and separate tunnel may be required. To build this portion of the Troy & Greenfield between North Adams and the Massachusetts and Vermont State line, will require,—

For graduation, masonry, and bridges, about . . .	\$120,578 00
For enlargement of Little Tunnel, . . . . .	52,300 00
For 6.84 miles steel track, . . . . .	82,080 00
	<hr/>
	\$254,958 00

#### SOUTHERN VERMONT RAILROAD.

This is a single-track railroad lying in the State of Vermont. It is 6.17 miles long. It is not in good condition. Wooden culverts and cattle-guards should give place to stone.

The maximum grade rising east is now about sixty-two feet per mile, for a short distance, and rising west, about fifty-three feet per mile. The sharpest curve is of  $3^{\circ}$ . This road is not in condition for a large business, and will have to be rebuilt or repaired at the expense of the Troy & Boston Co. If repaired on the scale proposed for the Troy & Greenfield railroad, the maximum grade east can easily be reduced to 31.68 feet per mile, and all the grades rising west to level planes.

The cost of putting this road into condition for a single track will be,—

For graduation, masonry and bridging, about . . .	\$179,260 00
For steel track, if used, . . . . .	74,040 00
	<hr/>
Total, . . . . .	\$253,300 00

In all the preceding estimates the amounts for single track include cost of first quality masonry for two tracks, a first-class track of sixty-pound steel rail, and iron bridges for single track ; iron being preferred, not alone on the ground of economy, but because indestructible by fire.

The following is a table showing characteristics and approximate cost of single and double line over the various portions, from Greenfield to Vermont and New York State line, supposing the road to be retained in its present location between Greenfield and Bardwell's :—



NAME OF SECTION.	Length in miles.	Max. grade per mile going West.	Rise in feet going West.	Max. grade per mile going East.	Rise in feet going East.	Max. curve in de- grees.	Percent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Cheapside to West Deerfield, . . . . .	4.51	52.8	121	0	0	6	49	116	\$214,500	\$138,253
West Deerfield to Bardwell's, . . . . .	3.47	32	6	23	60	6	32	127	247,410	58,480
Bardwell's to Shelburne Falls, . . . . .	5.24	50	221±	0	0	6	44±	156±	429,750	200,000
Shelburne Falls to Charlemont, . . . . .	7.86	50	126±	30.6	25±	6	60±	113±	227,350	278,000
Charlemont to Tunnel, . . . . .	9.07	50	226±	0	0	6	43±	146±	278,400	250,000
Hoosac Tunnel, . . . . .	4.75	26.4	59.93	26.4	61	0	100	0	64,125	64,125
Tunnel to North Adams, . . . . .	2.00	0	0	41.2	71.2	4	58	68	24,000	24,000
North Adams to Massachusetts and Vermont Line, .	6.84	0	0	32	121	6	62	46	254,958	177,580
Mass. and Vt. Line to Vt. and New York Line, .	6.17	0	0	32	85	3	66	52	253,300	166,550
	49.91	52.8	760	41.2	423	6	57	92	\$1,993,793	\$1,356,988

Leaving out the last item, viz., the Southern Vermont Railroad, and we have footings as follows:—

Troy and Greenfield Railroad, . . . . .	43.74	52.8	760	41.2	338	6	60	97	\$1,740,493	\$1,190,438
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I would here suggest that a contract be made soon for rebuilding that portion of the road west of North Adams, including the Little Tunnel. This latter will occupy considerable time, and should be out of the way before business begins to accumulate. Nearly all of the road west of the Tunnel can as well be graded up this winter as afterward, by putting in a steam-shovel and gravel-trains. The masonry should be left till spring, as well as the embankments over or adjacent to it.

Respectfully,

THOMAS DOANE,  
*Consulting Engineer.*

CHARLESTOWN, MASS., Dec. 23, 1874.





MAP SHOWING VARIOUS ROUTES  
for the  
**BOSTON HOOSAC TUNNEL**  
AND  
**WESTERN RAILROAD,**  
between  
Grout's Corner and Bardwells Station.  
to accompany  
**T. DOANE'S REPORT,**  
Dec<sup>r</sup> 1874.





[D.]

## REPORT OF MR. DOANE,

CONSULTING ENGINEER,

ON THE LOCATION OF ROUTE BETWEEN BARDWELL'S  
FERRY AND GREENFIELD.

[REFERRED TO IN THE REPORT, Page 7.]

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*To the Corporators of the Boston, Hoosac Tunnel, & Western Railroad,  
Hon. W. B. WASHBURN, President.*

I beg leave to submit the following report upon routes through Greenfield and Deerfield. It is believed that the seven different ones shown in the tables represent all the practical combinations.

They are each made to cover the whole distance between the extreme points of divergence, namely, Grout's Corner on the Vermont & Massachusetts railroad, and Bardwell's Station on the Troy & Greenfield railroad, so that their lengths, costs, and various characteristics can the more easily be compared.

The surveys were largely made by William P. Granger and Edwin Stratton.

## ROUTE NO. I.

This route begins at Grout's Corner, and runs by a new line, to be built through Turner's Falls and North Greenfield, to West Deerfield, and thence by the present line to Bardwell's. This route involves very heavy work between Grout's and Greenfield. It accommodates Turner's Falls and Greenfield, but leaves Montague out of the line. The route will cross overhead of Conn. River R. R. It is indicated on the plan by letters A, B, C, D, E, F.

NAME OF SECTION.	Length in miles.	Max. grade per mille going West.	Rise in feet going West.	Max. grade per mille going East.	Rise in feet going East.	Max. curve in degrees.	Per cent. of Straight Line.	Degrees of Curvature per Mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's Corner to Conn. River R. R. at North Greenfield via Turner's Falls, . . . . .	7.46	40	91	40	151	7	52	74	\$795,700	\$272,300
Conn. River R. R. at North Greenfield to Green River, . . . . .	.51	0	0	40	21	0	100	0	56,000	11,060
Green River to West Deerfield, . . . . .	4.13	32	86	0	0	5 $\frac{3}{4}$	75	49	426,100	107,130
West Deerfield to Bardwell's, via present line, . . . . .	3.47	32	6	23	60	6	32	127	247,410	58,480
	15.57	40	183	40	232	7	43	77	\$1,525,210	\$448,970

# ROUTE NO. II.

This begins at Grout's and runs by the present line to Cheapside, and thence to the present Greenfield Depot; thence by a new line crossing Green River by the Brick Yard to West Deerfield, and thence over the present line to Bardwell's.

This is not a very heavy line to build, presents favorable grades and curves, and accommodates Montague and Greenfield, but leaves Turner's Falls out of the line.

It is indicated on the plan by letters A, G, H, J, I, D, E, F.

NAME OF SECTION.	Length in miles.	Max. grade per mile going West.	Rise in feet going West.	Max. grade per mile going East.	Rise in feet going East.	Max. curve in de- grees.	Per cent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's to Cheapside Junction via present line Vt. and Mass. R. R., . . . . .	7.42	44	72	44	169	5	47	80	0	\$242,100
Cheapside Junction to Greenfield Depot, . . . . .	.75	17	5	0	0	$\frac{1}{2}$	*	*	0	20,000
Greenfield Depot to Green River, . . . . .	.57	32	9	0	0	$5\frac{3}{4}$	43	137	\$47,400	14,688
Green River to West Deerfield, . . . . .	4.13	32	86	0	0	$5\frac{3}{4}$	72	49	426,100	107,130
West Deerfield to Bardwell's, . . . . .	3.47	32	6	23	60	6	32	127	247,410	58,480
	16.34	44	178	44	229	6	50	129	\$720,910	\$442,398

\* Slight.

## ROUTE No. III.

This begins at Grout's, and runs substantially on the present line by Montague, Cheapside and West Deerfield, to Bardwell's. The worst physical feature in it is its heavy grade. It crosses the Connecticut River Road at grade.

It accommodates Montague, but does not accommodate Turner's Falls or Greenfield.

It is indicated on the plan by letters A, G, H, J, E, F.

NAME OF SECTION.	Length in miles.	Max. grade per mile going West.	Rise in feet going West.	Max. grade per mile going East.	Rise in feet going East.	Max. curve in de- grees.	Per cent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's to Cheapside Junction, via present line Vt. and Mass. R. R., . . . . .	7.42	44.0	72	44	169	5	47	80	0	\$242,100
Cheapside Junction to West Deerfield, via present line Troy and Greenfield R. R., . . . . .	4.51	52.8	121	0	0	6	49	116	\$214,500	138,253
West Deerfield to Bardwell's, via present line Troy and Greenfield R. R., . . . . .	3.47	32.0	6	23	60	6	32	127	247,410	58,480
	15.40	52.8	199	44	229	6	44	101	\$461,910	\$438,833



## ROUTE NO. IV.

This begins at Grout's, and runs over the present line to a point a little west of the Connecticut River Bridge, and thence by a new line passing *under* the Connecticut River R. R., a little south of its Deerfield River Bridge; thence through Deerfield Village and across the Deerfield River to a junction with present road west of West Deerfield Station, and thence to Bardwell's, over present road. This is the Laurie route substantially. It involves large expense for bridging Deerfield River, and is much exposed to Deerfield River freshets. It accommodates Montague and Deerfield, and leaves out of the line Turner's Falls and Greenfield. It is indicated on the plan by letters A, G, H, K, M, L, O, F.

NAME OF SECTION.	Length in miles.	Max. grade per mile going West.	Rise in feet going West.	Max. grade per mile going East.	Rise in feet going East.	Max. curve in de- grees.	Per cent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's to junction West of Conn. River via present line Vt. and Mass., . . . .	6.09	44	45	44	161	5	47	80	0	\$188,100
Junction West of Conn. River to crossing Conn. River R. R. near Deerfield River Bridge, . . .	.99	0	0	11	11	5 $\frac{3}{4}$	18	238	\$76,600	30,000
Crossing Conn. River R. R. near Deerfield River Bridge to junction with old line, . . . .	5.92	42	110	11	20	6	64	74	518,000	280,900
Junction with old line to Bardwell's, . . . .	1.56	0	0	18	14	5 $\frac{3}{4}$	56	114	70,609	20,592
	14.56	44	155	44	206	6	53	92	\$665,209	\$519,592

## ROUTE No. V.

This begins at Grout's and runs over the present line to a point a little west of the Connecticut River Bridge, and thence by a new line, passing *under* the Connecticut River Railroad, a little south of its Deerfield River Bridge; thence through Deerfield Village and by a route south of the Deerfield River and meadows to Stillwater; thence up the Deerfield Valley on its south side, about one (1) mile above the Suspension Bridge, where it crosses the Deerfield and runs up on the north side to Bardwell's. This is the most favorable line for grade and curvature, and avoids by an increase of length the exposure and cost incident to crossing the Deerfield River by Mr. Laurie's line. It accommodates Montague and Deerfield, and perhaps Conway, but avoids Turner's Falls and Greenfield. It is indicated on the plan by letters A, G, H, K, M, N, F.

NAME OF SECTION.	Length in miles.	Max. grade per mile going West.	Rise in feet going West.	Max. grade per mile going East.	Rise in feet going East.	Max. curve in de- grees.	Per cent. of Straight line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's to Junction West Conn. River, via present line, . . . . .	6.09	44	45	44	161	5	47	80	0	\$188,100
Junction West Conn. River to Crossing Conn. Riv. R. R., near Deerfield River Bridge, . . . .	0.99	0	0	11	11	5 $\frac{1}{2}$	18	238	\$76,600	30,000
Crossing Conn. River R. R., near Deerfield River Bridge, via Stillwater to Bardwell's, . . . .	8.00	22	95	11	20	5	65	77	437,413	233,860
	15.08	44	140	44	192	5 $\frac{1}{2}$	55	88	\$514,013	\$451,960

## ROUTE NO. VI.

This begins at Grout's and runs by a new line to be built through Turner's Falls to North Greenfield; thence by the side of the Connecticut River R. R. to its present Greenfield Depot, there crossing that road; thence by its westerly side across the Deerfield River by a new bridge; thence through Deerfield Village and across the Deerfield River again to a junction with present road west of West Deerfield Station, and thence to Bardwell's over present road. This route involves heavy expense at Turner's Falls and on the Deerfield meadows, besides exposure to Deerfield River. This route accommodates Turner's Falls, Greenfield, and Deerfield, but leaves out Montague.

It is indicated on the plan by letters A, B, C, I, J, K, M, L, O, F.

NAME OF SECTION.	Length in miles.	Maximum grade per mile going West.	Rise in feet going West.	Maximum grade per mile going East.	Rise in feet going East.	Maximum curve in degrees.	Per cent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's to Conn. River R. R. at North Greenfield via Turner's Falls, . . . . .	7.66	40	91	40	151	7	52	74	\$795,700	\$272,300
Conn. River R. R. at North Greenfield to Green- field Depot, . . . . .	.50	0	0	32	17	4	39	129	0	12,000
Greenfield Depot to crossing Conn. River R. R. near Deerfield River Bridge, . . . . .	1.31	0	0	26	34				174,500	70,000
Crossing Conn. River R. R. near Deerfield River Bridge to junction with old line, . . . . .	5.92	42	110	11	20	6	64	74	518,000	280,900
Junction with old line to Bardwell's, . . . . .	1.56	0	0	18	14	5 $\frac{3}{4}$	56	114	70,609	20,592
	16.75	42	201	40	236	7	56	78	\$1,558,809	\$655,792

## ROUTE No. VII.

This begins at Grout's, and runs by a new line to be built through Turner's Falls to North Greenfield; thence by the side of the Connecticut River R. R. to its present Greenfield Depot, there crossing that road; thence by its westerly side, across the Deerfield River by a new bridge; thence through Deerfield Village and by a route south of the Deerfield River and meadows to Stillwater; thence up the Deerfield valley on its south side, about one (1) mile above the Suspension Bridge, where it crosses the Deerfield and runs up on the north side to Bardwell's. This route incurs heavy expense at Turner's Falls, but accommodates Turner's Falls, Greenfield, Deerfield, and perhaps Conway, leaving out Montague.

It is indicated on the plan by the letters A, B, C, I, J, K, M, N, F.

NAME OF SECTION.	Length in miles.	Maximum grade per mile going West.	Rise in feet going West.	Maximum grade per mile going East.	Rise in feet going East.	Maximum curve in degrees.	Per cent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Grout's to Conn. River R. R. at North Greenfield, via Turner's Falls,	7.46	40	91	40	151	7	52	74	\$795,700	\$272,300
Conn. River R. R. at North Greenfield to Green- field Depot,	0.50	0	0	32	17	4	39	129	0	12,000
Greenfield Depot to Crossing Conn. River R. R. near Deerfield River,	1.31	0	0	26	34				174,500	70,000
Crossing Conn. River R. R. near Deerfield River, via Stillwater to Bardwell's,	8.00	22	95	11	20	5	65	77	437,413	233,860
	17.27	40	186	40	222	7	56	75	\$1,407,613	\$588,160



# APPENDIX

cxxiii

NAME OF ROUTE.	No. of Route.	Length in miles.	Maximum grade per mile going West.	Rise in feet going West.	Maximum grade per mile going East.	Rise in feet going East.	Maximum curve in degrees.	Per cent. of Straight Line.	Degrees of Curva- ture per mile.	Cost of Single Track, double for masonry.	Additional Cost of Second Track.
Via Turner's Falls, North Greenfield and West Deerfield, . . . . .	I.	15.57	40	183	40	232	7	43	77	\$1,525,210	\$448,970
Via Cheapside, Greenfield Depot and West Deerfield, . . . . .	II.	16.34	44	178	44	229	6	50	129	720,910	442,398
Via present route, . . . . .	III.	15.40	52.8	199	44	229	6	44	101	461,910	438,833
Via Montague and Deerfield, . . . . .	IV.	14.56	44	155	44	206	6	53	92	665,209	519,592
Via Montague, Deerfield and Stillwater, . . . . .	V.	15.08	44	144	40	192	5 $\frac{3}{4}$	55	88	514,013	451,960
Via Turner's Falls, Greenfield Depot and Deerfield, . . . . .	VI.	16.75	42	201	46	236	7	56	78	1,558,809	655,792
Via Turner's Falls, Greenfield Depot, Deer- field and Stillwater, . . . . .	VII.	17.27	40	186	40	222	7	56	75	1,407,613	588,160

The determination of the particular route to be adopted will probably be based both upon its engineering characteristics and the accommodation it will afford to local interests.

Some concessions to locality seem to be demanded, the more especially as local business will be much more remunerative to the line than through business.

Respectfully,

THOMAS DOANE,

*Consulting Engineer, etc.*

CHARLESTOWN, MASS., December 19, 1874.

[E.]

## OPINION OF THE ATTORNEY-GENERAL

ON THE CONSTRUCTION OF CHAPTERS 365, 402 AND 403 OF THE ACTS OF 1874, IN RELATION TO THE DUTIES AND AUTHORITY OF THE GOVERNOR AND COUNCIL AND THE BOSTON, HOOSAC TUNNEL & WESTERN RAILROAD COMPANY, OVER THE WORK TO BE DONE IN THE COMPLETION OF THE HOOSAC TUNNEL.

[REFERRED TO IN THE REPORT, Page 7.]

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COMMONWEALTH OF MASSACHUSETTS.

ATTORNEY-GENERAL'S OFFICE, }  
BOSTON, 7 COURT SQUARE, July 7, 1874. }

*To His Honor the Lieutenant-Governor :*

DEAR SIR :—In accordance with your request of this morning, I have examined chapters 365, 402 and 403 of the acts of 1874, and am of opinion that chapter 403, the act providing for the management of the Hoosac Tunnel, etc., does not relieve the governor and council from the duties imposed upon them by chapter 365, the act authorizing the governor and council to expend a sum of money not exceeding \$300,000, etc.

The later act (chapter 403) does not in terms, or by any reference, or by any general clause repealing other acts inconsistent with it, purport to repeal the earlier. Both acts were passed by the same legislature, with a difference of only five days in the dates of their respective approvals. The two acts are not upon the same subject-matter, the later being of a much more comprehensive and general character than the earlier. Certain provisions in the earlier, namely, those contained in chapter 3, are not covered by any of the provisions of the later act. If the later act was

construed to repeal the earlier, it would substitute another body than the governor and council for the acceptance of the Shanly contract. This could not be done without the consent of the Shanlys, as it would impair the obligation of a contract already made. If the legislature had intended to make any change in this respect, provision would have been made for the consent of the Shanlys. These considerations and others, which the shortness of the time at my command compel me to omit, lead me to the opinion that if the legislature had intended to repeal chapter 365 by chapter 403, passed almost contemporaneously with it, they would not have left such purpose to mere inference and implication.

In regard to chapter 402, the Act providing for the completion of the Troy & Greenfield railroad, I am of opinion that the last clause in section four of this act, relative to the expenditure of the appropriation, is repealed by chapter 403. The language of this clause is, that the expenditure shall be intrusted to the governor and council unless the legislature, by an act passed at the present session, makes some other provision with reference thereto. This clearly implies a possible repeal of that clause by the same legislature, and they did at once pass an act, namely, chapter 403, which, in section 6, expressly referred to this act, and which provided another body than the governor and council to which the expenditure of the money was intrusted. In regard to the extent of the power conferred upon the company created by chapter 403 over the money appropriated by chapter 402, I do not understand any question has yet arisen, and, perhaps, it would be premature to express in advance any opinion.

As the legislature have not provided that said company should give any bonds or security for the large sum of money appropriated by chapter 402, the more obvious conclusion is that all that was intended by the broad language used was, that the money should remain in the state treasury, subject to the order of the company, whenever it appeared by the proper vouchers that expenditures authorized by the act had been incurred.

This view of the matter is strengthened by the provision of chapter 360, section 2, of the Acts of 1874, "that no



greater sum from any appropriation for any institution, board or department of the State, shall be drawn from the treasury at any one time than is necessary to meet expenditures then incurred."

Very respectfully yours,

WILLIAM G. COLBURN,

*Assistant Attorney-General.*

## COMMONWEALTH OF MASSACHUSETTS.

ATTORNEY-GENERAL'S OFFICE, }  
BOSTON, 7 COURT SQUARE, July 20, 1874. }*To His Honor the Lieutenant-Governor :*

SIR :—Since our interview, on the 13th inst., I have carefully examined the opinion given by the Assistant Attorney-General under date of the 7th inst., and fully concur therein. The principal feature of chapter 365, Acts of 1874, is the power given by section 3 to the governor and council to make a settlement, under the Shanly contract, the grant of three hundred thousand dollars being made obviously for that purpose.

Chapter 402 is "An Act to provide for the completion of the Troy & Greenfield railroad," and chapter 403 "An Act to provide for the management of the Hoosac Tunnel and the Troy & Greenfield railroad," etc., etc. These two acts are both approved on the same day, and I am of opinion that the words in chapter 403, section 1, clause 4, "they shall hold all moneys," etc., etc., can refer only to the appropriation in chapter 402.

To apply these words to the appropriation in chapter 365, would defeat the operation of that chapter, which it is perfectly clear the legislature did not intend to do.

I am, very respectfully,  
Your obed't servant,

CHAS. R. TRAIN.

[F.]

## OPINIONS

OF

HON. E. R. HOAR AND JAMES C. DAVIS, Esq.,

AS TO THE LEGAL RIGHTS OF THE COMMONWEALTH IN REGARD TO  
CERTAIN RAILROADS CONNECTING WITH THE TROY & GREENFIELD  
RAILROAD.

[REFERRED TO IN THE REPORT, Pages 25, 26.]

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BOSTON, 30 COURT STREET, December 31, 1874.

Hon. WILLIAM B. WASHBURN :

SIR :—I respectfully transmit to you herewith the opinion of Hon. E. R. Hoar upon the legal questions arising under the third and fifth clauses of the second section of the act by which the Boston, Hoosac Tunnel & Western Railroad Company was incorporated.

It is provided by Rev. Stat. c. 39, § 84, that "The Commonwealth may at any time during the continuance of the charter of any railroad corporation, after the expiration of twenty years from the opening of said railroad for use, purchase of the corporation the said railroad, and all the franchise, property, rights and privileges of the corporation, by paying them therefor such a sum as will reimburse them the amount of capital paid in, with a net profit thereon of ten per cent. per annum, from the time of the payment thereof by the stockholders to the time of such purchase." This provision is reenacted by Gen. Stat., c. 63, § 138, and Stat. 1874, c. 372, § 180.

Section 45 of Rev. Stat. c. 39 (Gen. Stat. c. 63, § 1 ;

Stat. 1874, c. 372, § 4), is as follows:—"All railroad companies that have been or that shall hereafter be incorporated, under the authority of this Commonwealth, shall have all the powers and privileges, and be subject to all the duties, liabilities and other provisions contained in this chapter respecting such corporations, so far as the same are consistent with their respective charters."

Stat. 1874, c. 372, § 181 (reënacting Stat. 1870, c. 325, § 2), provides that "The Commonwealth may at any time take and possess the road, franchise and other property of any railroad corporation after giving one year's notice in writing to such railroad corporation, and paying therefor such compensation as may be awarded by three commissioners, who shall be appointed by the supreme judicial court, and shall be duly sworn to appraise the same justly and fairly; said commissioners shall estimate and determine all damages sustained by any such railroad corporation by such taking of the road, franchise and other property thereof; and any such corporation aggrieved by the determination of said commissioners may have its damages assessed by a jury of the superior court in the county of Suffolk, in the same manner as is provided by law with respect to damages sustained by reason of the laying out of ways in the city of Boston."

The Troy & Boston Railroad Company is incorporated under the laws of the state of New York, and no rights have been at any time reserved or granted to the Commonwealth in respect to taking possession of its road, which extends from Troy to the boundary line of the states of New York and Vermont.

The Southern Vermont Railroad Company was incorporated under the laws of the state of Vermont. Its road, which is about six miles in length, extends from its junction with the Troy & Boston railroad, at the state line of New York, through the town of Pownal, in Vermont, to the state line of Massachusetts. This road is owned by the Commonwealth under foreclosure of a mortgage given by the Troy & Greenfield Railroad Company. It is subject to a perpetual lease to the Troy & Boston Railroad Company, and is operated by this company, which pays for it an annual rent



of twelve thousand dollars. No right has been reserved to the Commonwealth to take possession of this road, except in the event of the failure of the lessees to pay the rent, and as it lies wholly without the jurisdiction of the Commonwealth, it cannot be taken under the right of eminent domain. The lease of the Southern Vermont railroad to the Troy & Boston Railroad Company, and the conveyances and legislation under which the Commonwealth derives its title to the road, may be found in Senate Doc. of 1862, No. 157, and Senate Doc. of 1874, No. 150, pp. 100-122.

The railroad extending from the state line of Vermont to the station at North Adams, about six and two-thirds miles in length, was constructed by the Troy & Greenfield Railroad Company, and is owned by the Commonwealth under foreclosure of its mortgages from that corporation. It is now operated by the Troy & Boston Railroad Company, under a lease from the Troy & Greenfield Railroad Company which is to continue until the completion of the Tunnel, and no longer. The lease is copied in Senate Doc. of 1874, No. 150, p. 78.

The railroad extending from the station at North Adams to the western end of the Tunnel, which is about two miles in length, has been lately constructed by the Commonwealth and is in its possession.

The Pittsfield & North Adams Railroad Corporation was incorporated in 1842, and its road, which is about twenty miles in length, and extends from Pittsfield to North Adams, has been open for use for more than twenty years. It is by its charter expressly made "subject to all the duties, liabilities and provisions contained in that part of the thirty-ninth chapter of the Revised Statutes which relates to railroad corporations." (Stat. 1842, chap. 69, sect. 1.) This road is leased to the Boston & Albany Railroad Company, and that corporation will be entitled to receive compensation for whatever damages it may sustain if the Commonwealth should take possession of the road.

The railroad extending from the eastern entrance of the Tunnel to Greenfield, which is about thirty miles in length, is owned by the Commonwealth, under foreclosure of its mortgages from the Troy & Greenfield Railroad Company,

and has been mainly constructed by the Commonwealth. It is now operated by the Fitchburg Railroad Company, under a lease to the Fitchburg and Vermont & Massachusetts railroad companies, which will continue in force until the completion of the Tunnel, and no longer. A copy of this lease may be found in Senate Doc. of 1874, No. 150, p. 74.

The Vermont & Massachusetts Railroad Company was incorporated in 1844, and its road has been in use for more than twenty years. It is, by its charter, expressly made "subject to all the duties, liabilities and restrictions contained in that part of the thirty-ninth chapter of the Revised Statutes which relates to railroad corporations, and in the several statutes, subsequently passed, relating to such corporations, and in the forty-fourth chapter of the Revised Statutes." (Stat. 1844, chap. 134, sect. 1.) This road is now subject to a lease to the Fitchburg Railroad Company for the term of nine hundred and ninety-nine years, from January 1, 1874, and if the State should take possession of the road under its right of eminent domain, that corporation will be entitled to compensation for such damages as it may sustain from the cancellation of the lease.

The charter of the Fitchburg Railroad Company contains a provision similar to that quoted from the act incorporating the Vermont & Massachusetts Railroad Company. (Stat. 1842, chap. 84, sect. 1.)

The Massachusetts Central Railroad Company was incorporated in 1869, and its charter provides that it shall be "subject to all the restrictions, duties and liabilities set forth in the general laws which now are, or may hereafter be, in force, relating to railroad corporations." (Stat. 1869, chap. 260, sect. 1.)

The twenty per cent. traffic contract of the Vermont & Massachusetts, Fitchburg, and Troy & Boston railroad companies with the Commonwealth, executed in February, 1863, is set forth in Senate Doc. of 1874, No. 150, p. 123. It was ratified by the legislature by Stat. of 1863, chap. 214. sect. 6.

I am very respectfully yours,

JAMES C. DAVIS.

O P I N I O N .

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My opinion is asked by the "Boston, Hoosac Tunnel & Western Railroad Company," upon the legal questions arising under the third and fifth clauses of the second section of Stat. 1874, chapter 403.

## I. UNDER THE THIRD CLAUSE.

1. The Commonwealth has reserved to itself the legal right of taking possession of each of the railroads incorporated by it, after the expiration of twenty years from the opening of the railroad for use, by paying to the railroad company such a sum therefor as will reimburse the company the amount of capital paid in, with a net profit thereon of ten per cent. per annum from the time of the payment thereof by the stockholders, to the time of such purchase. The process would include only the ascertainment of the amount to be paid, for which the reports required of the companies afford the requisite material, and the making of the payment. (Rev. Stat. c. 39, § 84; Gen. Stat. c. 63, § 138; Rev. Stat. c. 39, § 45; Stat. 1842, c. 84, § 1; Stat. 1844, c. 134, § 1; Stat. 1874, c. 372, § 180.)

As the election of the Commonwealth to purchase a railroad under this reserved right must be made through some act of legislation, it would be competent and proper in the same act to provide for the doing of whatever would be necessary to complete the purchase.

2. By Stat. 1870, c. 325, § 2, and Stat. 1874, c. 372, § 181, the right to take the railroad, franchise and property of any railroad corporation, is expressly reserved to the Commonwealth, upon giving one year's notice in writing, and upon payment of the value of what is thus taken, as ascertained by commissioners appointed by the supreme court, and, in case the corporation is dissatisfied, with the right to an assessment by a jury.



It will be observed that this provision of law, like the one before referred to, can have no practical effect without further legislation. It does not determine who shall give the notice in writing, or apply for the appointment of commissioners; nor does it become applicable to any particular railroad corporation without a new exercise of legislative will, and a provision for the money to pay for the franchise and property taken. I fail to see that it is of any force or effect, except as giving notice to railroad corporations of what may hereafter befall them.

3. But the more important questions I take to be, whether the two provisions are in any respect inconsistent with each other?—or whether either is in the nature of a contract with the railroad companies, which can impair or restrict the exercise of the right of eminent domain? I am very clearly of opinion that there is no inconsistency between them, and that neither affects in any respect the right of the State to take the franchise and property of a railroad corporation, whenever the legislature finds that a public exigency requires, upon making just compensation for the franchise and property taken.

The reservation of the right to take the railroad at the end of twenty years, on paying its capital and a profit thereon of ten per cent. per annum, is a stipulation in favor of the Commonwealth, by fixing an upward limit of price at which the property may be taken, although its value might greatly exceed that limit. It is perfectly consistent with this that the property should be taken at any time that the public good requires, on payment of its full value. Nor can the fact that the legislatures of 1870 and 1874 have notified the railroads that the Commonwealth may take their property at its ascertained value upon giving a year's notice in writing, prevent any subsequent legislature from enacting that it may be taken on a notice of a month, a day, or without any notice whatever. The taking by eminent domain, from a public exigency, for just compensation, impairs the obligation of no contract, because it recognizes the complete and entire title of the corporation to its franchise and property, and pays for it as for the property of any individual.

The principles of constitutional law upon which this view rests are so fully and clearly stated by our supreme judicial



court in the case of *Central Bridge Corporation v. Lowell* (4 Gray, 474), and are so completely sustained by the decisions of the supreme court of the United States there cited, that any further citation of authorities would be superfluous. That case, as it seems to me, settles the law for this Commonwealth.

## II. UNDER THE FIFTH CLAUSE.

I am not aware of any other contract to which this clause refers than that entered into in February, 1863, by the Troy & Boston Railroad Company, the Fitchburg Railroad Company, and the Vermont & Massachusetts Railroad Company, and approved, ratified and confirmed by act of the legislature, passed April 29, 1863.

By this contract, these railroad corporations, in consideration that the Commonwealth would complete the Hoosac Tunnel and the Troy & Greenfield railroad, agreed to pay to the Commonwealth one-fifth of their gross earnings upon such business as should pass over any part of the said Troy & Greenfield railroad.

I can see no reason to doubt the validity and binding effect of this contract upon the several corporations named. Its purport is clear and obvious, and seems to need no explanation. Its value may depend upon the question, whether the railroads can afford to do the business referred to upon such terms. If they cannot, and the contract is so improvident that it would be ruinous or greatly injurious to them, as there is nothing in the law or the contract to limit the price which they shall charge for the business, they would be likely to protect themselves by fixing such rates of fares and freights as would result in doing very little business of such an unprofitable kind. The value of a contract thus limited would not probably be great, and it would undoubtedly not be sound policy for the Commonwealth to adhere to a contract which should interfere with the use of the Tunnel to the fullest extent upon reasonably remunerative terms.

E. R. HOAR.



No 13

SENATE....No. 283.

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Commonwealth of Massachusetts.

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EXECUTIVE DEPARTMENT, BOSTON, May 10, 1871.

*To the Honorable the Senate.*

In compliance with the Order adopted by the legislature, I have the honor to transmit herewith copies of the Reports of James Laurie, late Consulting Engineer on the Hoosac Tunnel.

WILLIAM CLAFLIN.

HARTFORD, May 25, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—I duly received your communication of the 8th inst., informing me that I had been appointed Consulting Engineer on the Hoosac Tunnel, and on the 12th inst. I visited the work, and, in company with Benjamin D. Frost, Esq., the superintending engineer, made a general examination of the several sections.

The contract entered into with Messrs. W. & F. Shanly for the completion of the tunnel bears date December 24th, 1868. Work, however, was not commenced until March 26th, the contractors being occupied with details of sale and transfer of the property belonging to the State and other preliminary matters. Since the latter date they have been gradually increasing their force and appliances, and have now about 400 men employed.

The following are the dates, as furnished me by Mr. Frost, at which the several sections were commenced:—

1869.

*East End.*

March 29. Commenced east end heading, working pneumatic drills.

“ 29. Commenced enlargement of tunnel, 1st gang.

April 4. “ “ “ “ 2d gang.

*Central Shaft.*

April 5. Commenced bailing water.

“ 17. Reached bottom.

“ 19. Commenced repairing timber work of shaft, &c.

*West End.*

March 26. Commenced excavation for brick arch (Hocking & Holbrook, sub-contractors).

April 5. Commenced first enlargement of tunnel (Dawe & Dobson, sub-contractors).



- April 15. Commenced central drain, east of west shaft (Doisgenoit, sub-contractor).
- May 3. Commenced second enlargement (Gregory, sub-contractor).
- “ 12. Commenced third enlargement (Callihan & Co., sub-contractors).
- “ 12. Commenced making brick.

On May 1st the following progress had been made:—

*East end* heading had progressed 110 feet. East end enlargement by two gangs 225 feet.

*Central Shaft.*—Repairs of timber work and enlargement of shaft, in progress.

*West End.*—Brick arch, central drain and enlargement of tunnel, in progress.

Unfortunately, the places at which progress has been made, except at the east end heading, are not the governing points for the speedy and final completion of the work. These are the sinking of the central shaft to the floor of the tunnel, so as to prosecute the work east and west from it, and the west end main heading. At these points no other than preliminary work has yet been commenced.

At the central shaft, a scarcity of carpenters, and the extra cost and difficulty of working more than one gang, are the reasons assigned why greater progress has not been made.

Sinking could have been commenced by hand labor as soon as the water was bailed out and the scaffolding and timber work repaired,—thus placing the shaft in the same condition as when previously worked,—leaving the enlargement and trimming required, which is mainly near the bottom, to be done while making downward progress, without material hindrance to the work.

By the contract the shaft has to be sunk to the floor of the tunnel by May 1, 1870, requiring an average monthly progress from the first of January last of 28 feet, but five months will have elapsed by June 1st with no progress made, increasing the average to  $40\frac{1}{10}$  feet for the remaining eleven months. This is a greater average than can be accomplished by hand labor, but

the contractors intend using machine drills and feel sanguine that they can complete it within the time specified.

Every month its completion is delayed will virtually postpone the completion of the tunnel six weeks, and add to its cost.

The capital invested in the tunnel, by the State, say at the time mentioned for the completion of the whole work, will, after deducting the \$1,000,000 reserved from the contractors, amount to about \$6,600,000, the interest on which at five per cent. is \$27,500 monthly, or \$900 per day; while the contractors on the \$1,000,000 reserved will be losing interest, equal, at five per cent., to \$4,166 monthly, or \$137 per day.

At the west end the contractors have removed the power and ventilation pipes between the shaft and the advance heading, to allow of greater convenience for completing the central drain and the laying down of new pipes, and progress at the heading cannot be made until the new pipes are laid.

At the time of my visit they were working only one gang 10 hours per day on this work.

I certainly would have deemed it advisable to have maintained the old pipes by temporary connections while building this drain, although at an extra cost, than to have delayed commencing work at the heading, but it is now too late, as it would require nearly as much time to relay them and make temporary connections as to prosecute the permanent works to completion.

The date of the completion of the tunnel will depend largely on the progress made at the central shaft and west end heading, and I will urge and recommend that in the future, progress at these points be maintained by resorting to temporary expedients and working by hand labor when they cannot from any cause keep the pneumatic drills in operation.

The contractors expected to have both these points in a condition to commence actual progress about the 28th instant, but from the limited force employed I think it will be the first or second week of June before they make much headway.

All sections of the work will then be in a most favorable condition for rapid progress, and during the next and succeeding months favorable results ought to be obtained, and, with due foresight on the part of the contractors to provide machinery and labor, ventilation, power, drills, nitro-glycerine and gun-

powder, I see no reason why much greater progress should not be made than has heretofore been accomplished, but the moment the policy is adopted of letting one thing wait for the completion of another, there will be lost time, and while I feel confident that increased progress can be made by improvements on the drilling machinery, I would mainly rely, for the completion of the work within the contract time, on continued and uninterrupted progress either by machine drills or hand labor, keeping one or the other, night and day, always at work.

In addition to the monthly estimates on which payments are to be made, I consider it desirable that a monthly return be made out in a tabular form, showing not only the work done during the month, but what remains to be done, with the time required to complete the same, from the progress made and making. By next month I will endeavor, along with Mr. Frost, to prepare a form adapted to the purpose.

Respectfully submitted.

JAMES LAURIE,  
*Consulting Engineer.*

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HARTFORD, June 28, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—Having recently returned from the Hoosac Tunnel, I beg to submit the following report:—

At the *east end* the heading is progressing satisfactorily, and will probably show an advance of fully one hundred and forty feet during the present month, being a greater progress than has heretofore been accomplished.

On the enlargement, work is being prosecuted at two places. About sixty men are employed. This force must be considerably increased to complete the work at the contract time. At the rate of progress made during the month of May, it would require sixty-seven months to complete the enlargement of the old heading, and eighty-one months to complete the full



size tunnel. There is no difficulty, at present, in applying a much larger force of hand labor, but the contractors are waiting for movable staging and pneumatic drills with which they mean to operate on this portion of the work. My own opinion is that the enlargement would cost no more prosecuted by hand drilling than if prosecuted by machine drills, while every month that progress is delayed will necessitate a larger force to be put on the work, and increase the difficulty of loading and removing the material, which, in fact, is what will eventually regulate the effective progress, and not the amount of rock that may be blasted in a given time. I consider it of importance, therefore, to push the enlargement so as not only to keep pace with the new heading, but to gain on it, until brought under perfect control. Every cubic yard removed is a gain towards final completion.

To prevent stoppages of the work from low water in the summer and from anchor ice in the winter, the Messrs. Shanly some months ago contracted for four double compressors to be worked by steam power. These machines have not as yet been delivered, and as it will take three or four weeks to erect them, it is possible, if they are not delivered soon, that there may be some detention from low water. The contract for the compressors, unfortunately, does not specify the time for their delivery, and the manufacturers appear to be crowded with orders.

*Central Shaft.*—This is progressing satisfactorily by hand labor. The contractors, I think judiciously, did not wait for the completion of the permanent fixtures in the shaft, and for new pneumatic drills, but commenced sinking the latter part of May by hand labor, and up until the 25th instant had sunk about 32 feet. When the two pneumatic drills which have been ordered are received and put in place, the contractors expect to make a progress of 50 feet per month, which will complete the shaft in about nine months. The progress for three days by hand labor and nitro-glycerine has been about eighteen inches per day.

At the *west end* not much progress has been made. A partial strike among the miners employed on enlargement caused a few days' interruption, and several of the men have left the work. They objected to working in ten-hour shifts, and wished to



establish eight hours as a day's labor. On the 24th instant there were two shifts of fifteen men each at work.

Nothing has been done at the west heading. The contractors last month thought all the necessary power-pipe had been delivered, but they still lack 300 feet to complete a double line to the heading. They will commence work about July 1st, working by the power supplied by one pipe, which will keep four or five drills in operation until the balance of the pipe arrives, which was only ordered on the 24th instant from Philadelphia.

The brick arching is proceeding at a progress which will complete it in 40 months.

Nitro-glycerine is now used at all of the workings except one of the enlargements. The use of this explosive has had a marked effect on the progress made. The contractors expect that by its continued use the monthly advance will be increased from 30 to 50 per cent., and the results of the last few days appear to confirm their expectations.

Very respectfully, your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

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HARTFORD, August 3, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—I spent last week in examining the work at the Hoosac Tunnel, and beg leave to submit the following report:

The work done during the month of July will fall short of the amount accomplished the previous month. The estimates are not completed, but the following will exhibit, approximately, the progress made:—

East end heading advanced about . . .	145 feet.
West end heading “ “ . . .	69 “
Central shaft sunk about . . .	24 “

The *east end heading* has been worked with full gangs and has progressed satisfactorily. The reduced progress is due to the national holiday intervening, and from the men not having worked for some three days during the month. On the enlargement the gangs have been small, and the amount of rock removed will be considerably less than last month.

*Central Shaft.*—The accident which occurred here on June 30th, by which three men lost their lives, caused considerable interruption to the work, several of the men having left. The gangs are, however, again full and more rapid progress may be expected.

Two pneumatic drills adapted to working in the shaft were expected to be put in operation about the second instant, and it is hoped will add considerable to the progress during the present month.

At the *west end heading* operations were commenced July 2d, by working with five of the old pneumatic drills. The new ones which were ordered have arrived, but as they require a different size of drill-bar from that heretofore used, the contractors have been obliged to order bars specially manufactured for the purpose, and until they are received but little progress will be made. The rock at this end is at present largely mixed with quartz and is hard to drill.

The aggregate amount of rock removed in the month of June from the several sections, was only five-eighths of the amount required to be taken out monthly by the rates of progress prescribed in the contract, and the estimate for the month of July will probably show a still less proportion of work accomplished.

To comply with the contract more force is wanted, but the contractors find difficulty in procuring workmen. One hundred and fifty additional men could readily be employed, and unless they are put on, the monthly progress will fall short of the requirements of the contract until it will be difficult to apply sufficient force to complete the tunnel at the time specified.

The work is now in a condition that the monthly estimates afford a very fair index of the progress making and force required.

To complete the tunnel at the contract time requires that the estimates shall average nearly \$80,000 monthly. The June estimate was \$56,700, and the July estimate will be considerably less.

Respectfully submitted,

JAMES LAURIE, *Consulting Engineer.*

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HARTFORD, September 16, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The amount of work done on the Hoosac Tunnel during the month of August, as will be seen by the estimate, was in excess of previous months. This was mainly due to a larger force having been employed; the number of days' labor during the month being 1,937 more than in July.

*East End Section.*—The advance made at the east end heading was 130 feet. A greater progress would have been made here had not low water in the Deerfield River compelled a reduction in the force employed.

From the 7th to the 16th there was insufficient power to operate continuously the ordinary number of pneumatic drills, and in consequence the working shifts were reduced to two, and the number of drills operated to three to each drill-carriage.

The steam-boilers and compressors intended to supply power during a low stage of water, have been delivered, but are not yet in working order; some portions of the fixtures are still lacking.

*Central Section.*—The central shaft was sunk 33 feet during the month. The pneumatic drills, by which the contractors expected to make up for delay in commencing the work, were put in operation at the beginning of the month, but proved to be cumbersome and unwieldy to work to advantage, and after a trial of a few days were removed. It is the intention to construct new frames for the drills, and try them again.

At the rate of progress made by hand labor for the last three

months, it will require 122 months to complete the shaft down to grade, which will be  $4\frac{1}{2}$  months beyond the contract time.

*West End Section.*—The brick arch and the enlargement have progressed satisfactorily.

The advance made at the heading was only 58 feet during the month. This small progress was due to the hardness of the rock, and from using gunpowder for blasting in place of nitroglycerine, with a view to economy. Gunpowder was still used September 13th, but the contractors intended again using nitroglycerine as soon as they could obtain a supply of *exploders*, of which they had exhausted their stock in hand. The rock at this heading is now more favorable than it has been heretofore.

At both the east and west end headings a soft seam of rock was encountered during the month. That at the east end is 14 feet thick, and that at the west end 9 feet thick, measured on the line of the tunnel. At both places arching will be required. For the present the roof is supported by timbers.

These seams have the appearance of being mere fractures following the general line of stratification. They are filled with fragments of the mountain rock, imbedded in fine particles of the same, probably brought down and deposited by the percolation of water.

Respectfully submitted,

JAMES LAURIE,  
*Consulting Engineer.*

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NORTH ADAMS, October 13, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The amount of work done at the Hoosac Tunnel during the month of September does not materially vary from that accomplished in the month of August. The money value of the work in September was \$63,814 71, and in August \$64,437.90.

At the east end heading the advance made was 135 feet, and at the west end heading, 76 feet. The central shaft was sunk  $28\frac{1}{2}$  feet.



The rock met with during the month was of an average character, and no unordinary difficulty was encountered. An additional gang was put on the enlargement at the east end September 30, and the number of men then employed on the whole work was 636 ; being an increase of 44 over the previous month.

The steam-boilers intended to work the supplementary compressors at the east end have not as yet been fitted up, but it is expected they will be ready for use in the course of ten days.

Everything looked favorable for satisfactory results during the month of October, until the destructive rain storm of the 3d and 4th instants, but this storm caused so much damage at the west end workings that all progress will be stopped there for several weeks to come.

The principal damage was occasioned by the brook, which runs on the northerly side of the railroad, bursting its banks. This stream formerly crossed the line of the tunnel about 350 feet east of the present western portal, but was diverted some years since by excavating a new channel, parallel with and 150 to 200 feet north of the line of the railroad. On the 4th instant the brook was much swollen by the previous rains, and about 11, A. M., suddenly undermined its banks about 200 feet east of the portal, and poured its waters into the hollow formed by the excavations made while constructing the brick arch. The rush of water and *debris* followed the northerly line of the brickwork and, cutting a gap of about 25 feet in depth through the material covering the arch, poured over into the space of 25 feet between the portal and the Haupt tunnel.

This material, together with a timber crib which protected the end of the arch, appears to have formed a perfect dam—preventing the water from running through the Haupt tunnel and backing it up into the brick tunnel, which rapidly filled. The surplus then ran over the top of the Haupt tunnel until a portion of it fell in, giving vent to the water.

So sudden was the rise that in one and a half hours the water had risen 15 feet above the top of the brick arch, and backed up through the drift-way into the workings east of the west shaft, filling them as far as the advance heading.

The men in the various workings made their escape, with the exception of one, who had only been at work for a few hours in

the tunnel, and, probably from want of knowledge of the means of escape, got drowned.

So tight is the dam, formed by the *debris* brought down, that the water of the upper side still remains about one foot above the top of the brick arch at the portal.

The contractors put a large force to work on the 5th instant, to stop the breach in the bank of the brook, and only succeeded on the 12th instant in confining the stream to its old channel.

Mr. Frost estimates that about 5,000 cubic yards of material has run into the brick and Haupt tunnels and road-bed, and until it is removed and the water allowed to escape, no progress can be made at any of the workings at the west end. Mr. Frost is keeping a careful record of the time and cost of repairing the damages done.

At the east end the Cascade Brook, so called, immediately north of the entrance to the tunnel, poured down such a volume of water and *debris* as to cause a rise of six feet at the portal, but the water soon subsided, and the work was only interrupted for about one day. The channel of this brook will have to be deepened and enlarged.

The outer embankment of the canal, at several places between the dam and compressor-house, has suffered considerable injury by the washing away of the outer slope. This will require to be promptly repaired, and the contractors have stated that it is their intention to do so.

An explosion of about 500 pounds of nitro-glycerine occurred on the 9th instant, in the magazine at the east end, where three men were employed; all three were killed. The precise cause of the explosion is not known.

On September 12th a man was killed at the central shaft by the dropping of the cross-head attached to the bucket guides, and another, on the 28th, received injuries by falling from one of the platforms in the shaft, from which he died the following day.

This is rather a melancholy record of accidents, occurring within little more than a month, but it is fortunate that the bursting of the brook embankment occurred in the day-time. Had it taken place at night nearly 100 lives might have been lost.

A committee of your honorable council having visited and examined the work, they authorized Mr. Frost to adopt all necessary measures for the protection of the brick tunnel against the unequal strain brought upon it by the washing away of the material from one side.

The Messrs. Shanly intend to proceed at once to remove the dam formed at the western portal and draw off the water now accumulated in the workings, which they think they can accomplish during the present month.

Respectfully submitted,

JAMES LAURIE,  
*Consulting Engineer.*

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NORTH ADAMS, November 13, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The amount of work done at the Hoosac Tunnel during the month of October was only a little more than two-thirds of that accomplished in each of the preceding months of August and September. This was mainly in consequence of the damage done by the heavy rain storm of October 4th.

The reduction in the amount of work done is confined entirely to the west end, where operations were suspended from October 4th to the 25th. On the latter date the water in the tunnel was lowered sufficiently to allow of work at the heading, and the inner breast of the heading enlargement, being prosecuted, but it was not until the 10th instant that the water was drawn entirely down.

There is still a considerable quantity of material to be removed from the inside of the brick tunnel, and it will be several days yet before work can be resumed on the arch.

During the month, the advance of the east end heading was 132 feet; the central shaft was sunk  $32\frac{1}{2}$  feet; and the west end heading advanced 29 feet.

The channel of the brook, the overflow of which caused the difficulty, has been deepened and enlarged, and the line of the

travelled road has been changed by forming an embankment 20 feet in width along the south side of the stream. This will afford a good protection against any similar flood.

At the east end the contractors have made some repairs on the northern portion of the canal embankment injured by the freshet, but have not made it as strong as before. Nothing has yet been done to the southern part of the embankment.

The lower apron of the dam suffered some injury by the stripping off of a few of the sheathing plank, and a hole has been excavated by the current at the lower end of the timber work. The plank ought to be replaced and the hole filled up with large stone, as it is only by keeping the dam and its appurtenances in perfect order that they can be relied upon to resist the action of future freshets. The contractors being absent during the week I was on the work, I did not learn their intentions.

Arrangements are being made to test the efficiency of the diamond drill, worked by compressed air, on the enlargement at the east end. From my knowledge of its performance at other places, I entertain some hopes of its success.

On the 11th instant work at this end was stopped for half a day in consequence of the accumulation of anchor ice in the canal.

Respectfully submitted,

JAMES LAURIE,  
*Consulting Engineer.*

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NORTH ADAMS, Dec. 14, 1869.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of November was as follows:—

East end heading advanced,	.	.	.	.	147 feet.
West end heading advanced,	.	.	.	.	115 "
Central shaft sunk,	.	.	.	.	30 "

The amount of the estimate for the month is \$62,628.47.



The increased advance at the west end was due to the rock being of a more favorable character than met with for some time, but it is again growing harder.

A letter, of which the following is a copy, was this day addressed by Mr. Frost and myself to the contractors calling their attention to the small progress making.

ENGINEER'S OFFICE, HOOSAC TUNNEL, NORTH ADAMS, MASS., }  
December 14, 1869. }

Messrs. WALTER and FRANCIS SHANLY, *Contractors for completion of Hoosac Tunnel.*

On the first day of November, 1869, value of work remaining to be done under your contract was \$4,225,035.17, and the amount of contract time remaining was 52 months, making the *general average* of work required *per month* \$81,250.67.

The value of work done during the month of November, as shown by the estimate December 1, 1869, has been \$62,628.47.

Taking the specific requirements of your contract, and rejecting from the comparison those portions of the work which are not yet accessible and those in which an intermittent progress is possible and sometimes appropriate, it appears that for the month of November, *present average* required was \$79,617.82, while the value of work done in November, as above stated was \$62,628.47.

This statement is transmitted to remind you of existing deficiencies of progress; and it is thought proper at the same time to urge upon you the necessity of increasing your force up to such a standard as shall enable you to satisfy the full requirement of your contract. Yours respectfully.

BENJ. D. FROST, *Superintending Engineer.*  
JAMES LAURIE, *Consulting Engineer.*

Workmen can now be readily procured, and the work is in good condition to make rapid progress.

Very respectfully, your ob't servant,

JAMES LAURIE,  
*Consulting Engineer.*

NORTH ADAMS, Jan. 14, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR—The progress made at the Hoosac Tunnel during the month of December, was as follows:—

East end heading advanced,	. . . . .	146 feet.
West end heading advanced,	. . . . .	102 “
Central shaft sunk,	. . . . .	30 “

The estimate for the month as made out by Mr. Frost amounts to \$65,561.22.

I forward it without my signature, as there are several discrepancies in the estimated quantities which involve the questions of the amount due the contractors, and whether the contract is for a *lump* sum or by the cubic yard. I had supposed that it was well understood that the contract was for a lump sum.

The number of men employed on the work January 1st, was 642, being only 6 more than in September and 8 more than in November last.

On the 7th inst., work at the east end heading was stopped by the accumulation of anchor ice in the canal, and had not been resumed on the 12th. On the other sections there has been no interruption.

Very respectfully, &c.,

JAMES LAURIE, *Consulting Engineer.*

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*To His Excellency the Governor and the Honorable the Executive Council of the Commonwealth of Massachusetts.*

Having received the appointment of consulting engineer on the Hoosac Tunnel in May last, it becomes my duty to report on the progress of the work and its present condition.

A contract had been made December 24th, 1868, with Messrs.

W. & F. Shanly, for the entire completion of the tunnel, ready for use, by March 1st, 1874, for the sum of \$1,594,268.

By the provisions of the contract the contractors are to receive no payment until they shall have earned, at the schedule prices, according to the certificates of the engineer or engineers, approved by the governor and council, the full sum of \$500,000 ; and, thereafter, twenty per cent. in addition is to be retained from the monthly payments until the whole work is completed and accepted by the governor and council. The amount thus to be retained by the Commonwealth as security for the full performance of the contract, will, at the final completion of the work amount to a sum exceeding \$900,000.

The contract also provides that certain rates of progress shall be made monthly on the several sections from and after such time as notice shall be given by the governor and council, which time, however, was not to be earlier than the first day of May, 1869, and was not given until May 26th, to take effect and be operative from July 1st, 1869.

Considerable delay appears to have occurred after the date of the contract, in actually commencing the prosecution of the work, the contractors being occupied in preliminary arrangements for the fulfilment of their part of the contract, and in obtaining the transfer of machinery, tools, etc., belonging to the Commonwealth.

Although work was begun on some portions in March, it was not until July 2d, or more than six months after the date of the contract, that all of the several sections were actually put under prosecution.

Unfortunately, some of the places on which a commencement was delayed, were the controlling and governing points for the speedy completion of the work.

#### *East End Section.*

Operations were commenced here, both on the advance heading and on the tunnel enlargement March 29th, and have been continued without material interruption since. The rock throughout has been of a very uniform and favorable character, and has been almost entirely free from water.

*TABLE showing the Monthly Progress at the several Workings of the East End from the recommencement of the Work up to January 1st, 1870, to which is appended (as also to subsequent Tables of Progress), a Comparative Statement showing the average amount of Work performed Monthly since July 1st; also the average amount required by the terms of the Contract, together with a Statement of the Work remaining to be Done.*

D A T E S.	TUNNEL EXTENSION.			Heading Enlargement. Cubic yards.	Tunnel Enlargement. Cubic yards.	Total Rock Excavated. Cubic yards.
	Distance from Portal. Linear feet.	Progress of Heading. Linear feet.	Rock excavated. Cubic yards.			
March 29, 1869,	5,283	Begun,	-	-	-	-
May 1, "	5,393	110	816	188	415	1,419
June 1, "	5,528	135	1,020	409	335	1,764
July 1, "	5,685	157	1,202	539	332	2,073
August 1, "	5,832	147	1,104	453	271	1,828
Sept. 1, "	5,962	130	1,147	704	320	2,171
October 1, "	6,097	135	846	412	336	1,594
Nov'ber 1, "	6,229	132	1,072	1,019	251	2,342
Dec'ber 1, "	6,376	147	1,048	1,010	538	2,596
January 1, 1870,	6,522	146	1,020	1,062	381	2,463
	-	1,239	9,275	5,796	3,179	18,250
Average per month since July 1st, .	.	139½	1,039	777	350	2,166
Average per month required by contract, .	.	120	2,049	716	47	2,812
Work remaining to be done, .	.	4,096	75,825	22,204	1,321	99,350



Since July 1st there has been a gain of 87 feet in the advance of heading of the tunnel extension beyond the prescribed progress, but no work having been done on the enlargement of the same, the number of cubic yards of rock removed is only about one-half of the required quantity.

During the months of both August and September, although the past season was a wet one, there were interruptions of about eight days caused by low water in the Deerfield River, there being only power sufficient to operate half the usual number of drills. To prevent stoppages of the work from this cause and from anchor ice in the winter, the contractors, early in the season, made arrangements for the erection of steam compressors of power equal to working ten pneumatic drills, and expected to have had them ready for use by the month of August, but the manufacturers failed to furnish them in time; they were not completed until October, and were used for a few days during the past month to supply ventilation while the canal was blocked by anchor ice.

#### *Central Section.*

Work was commenced on April 5th by the bailing of water from the shaft, which was nearly two-thirds full, and on the 17th the bottom was reached. Repairs of the timbering were then proceeded with, also the trimming of the shaft at the bottom, which had been allowed to get out of line when previously worked. New air-pipes were also put down for the purposes of ventilation and working of pneumatic drills, but actual work in sinking was not commenced until May 20th. The drilling, so far, has been done by hand labor, except for part of two days in September, when pneumatic drills were tried, but as they did not work satisfactorily, the frames in which they were placed proving cumbersome and unwieldy, they were removed.

It was the intention of the contractors to have new and lighter frames made, but I do not learn that anything has been done towards their construction.

*Table of Progress from May 20th, 1869, to January 1st, 1870.*

	Progress in feet.	Distance down in feet.
Depth previously sunk, . . . . .	. . .	583
1869. May 20. Began sinking.		
“ June 1, . . . . .	7	
“ July 1, . . . . .	29	
“ August 1, . . . . .	25	
“ September 1, . . . . .	33	
“ October 1, . . . . .	28 $\frac{1}{2}$	
“ November 1, . . . . .	32 $\frac{1}{2}$	
“ December 1, . . . . .	30	
1870. January 1, . . . . .	30	
		215
Distance down January 1, 1870, . . . . .		798
Remaining to be sunk to each grade of tunnel, . . . . .		232
Total depth of shaft when down to grade, . . . . .		1,030

To complete the 232 feet remaining to be sunk will, at the average progress made during the last four months, require seven and two-thirds months, or until September 20, 1870, which will be three and two-thirds months beyond the time specified in the contract.

The rock has been of a very favorable character, being, perhaps, on the whole, easier to excavate than that met with at the east end workings.

There has been no material increase of water in sinking the shaft, no new springs of any account having been met with. The vigorous prosecution of this work is all important, so as to reach grade and commence extending the tunnel east and west from its bottom.

#### *Rain Storm of October 4, 1869.*

Before stating the progress made at the several workings of the west end, it may be proper to give an account of the damages done by this storm.

The rain fell almost continuously from the morning of the 3d to the afternoon of the 4th, the heaviest fall being in the forenoon of the 4th, which raised the streams to an extraordinary height.

The *rain-fall* for the two days, as registered at Williams College, was 6 inches, at Pittsfield 6 inches and at the Springfield armory 8.05 inches. At the latter place 3.45 inches fell between 7 A. M. and 1 P. M. on the 4th.

At the west end of the tunnel, a brook which formerly crossed and run near the line of the railroad, was diverted by the commissioners in 1864 by excavating a new channel parallel with and about 150 feet north of the road.

This stream on the 4th was much swollen by the previous rains, and about 11 A. M. suddenly overflowed its banks about 200 feet east of the Portal, where it was about 75 feet above grade line, and poured its waters on the northerly side of the Farren tunnel, cutting a gap about 25 feet in depth through the material which had there been deposited since the completion of the arch. This material was run into the space between the old Haupt tunnel and the present Portal and formed a perfect dam, preventing the water from running through the Haupt tunnel and diverting it into the brick tunnel. So large was the volume of water, that in two hours it had risen 15 feet above the top of the arch and backed up through the driftway into the workings east of the west shaft, filling them as far as the advance heading. The surplus then ran over the top of the Haupt tunnel until a portion supported by timbers burst in, allowing the water to follow the line of the railroad.

A large amount of material was run into the brick and Haupt tunnels. To remove this sufficiently, so as to lower the water and allow of work being resumed at the heading, occupied three weeks, and it was not until November 10th that the water was drawn entirely out of the lower workings.

This same brook, it appears, was diverted by Haupt & Co. in their operations at the west end, through a channel on the south side of the railroad, and it then overflowed its banks, doing much damage to their works.

The present channel has been deepened and enlarged, and an embankment twenty feet in width made between it and the railroad. The travelled road has been transferred to this embankment and will afford protection against any similar flood, provided it is maintained, together with the channel, in good condition. The channel excavated by Haupt & Co. on the south side of the railroad carries a stream which is elevated



a considerable height above the road, and is liable by overflow or obstruction to be precipitated into the road-bed. This also requires watching.

At the east or Deerfield end some damage was also done. Cascade Brook, so called, immediately north of the entrance to the tunnel, poured down a large volume of water, together with boulders and gravel which filled up the channel of the brook and covered the road-bed. At the Portal the water rose six feet in height and flowed back into the tunnel for a distance of 1,600 feet, but the course of this stream being short, having its rise on the eastern slope of the mountain, the water soon subsided, causing a delay of only about sixteen hours in removing the material from the track. The rocky nature of the ground prevented any serious injury from the current, but the *debris* brought down (about 1,000 cubic yards) will have eventually to be removed, and the channel of the brook deepened and enlarged.

Considerable injury was also done to the canal embankment, between the dam and compressor-house, by the rise of water in the Deerfield River.

The current washed away portions of the protection wall and outer slope of the embankment. The dam sustained but little injury. A few plank were stripped from the lower apron, and a hole 8 to 9 feet in depth below the top of the apron was excavated by the current in the bed of the river.

The damage done to the embankment has been partially repaired, but nothing has been done at the dam. These damages ought to have been thoroughly repaired before the setting in of winter, but the contractors failed to do so. It is only by keeping the dam and appurtenances in perfect order that they can be relied upon to resist future freshets.

#### *West End Section.*

Work at this end was commenced in March by enlarging and repairing buildings, and overhauling the old and erecting new machinery. The contractors also removed the air-pipes leading to the heading, intending immediately to substitute pipes of a larger size, but they were not delivered for some considerable time after, and the work could not be prosecuted for want of ventilation.



I believe that it would have been the true policy to have worked with the old machinery, or even with hand labor until the new pipe and compressors were ready to put in place. To have done so would have considerably advanced the work at this end.

The enlargement was commenced April 5th, but for the reasons above stated, work at the east heading, which is the governing point for the speedy completion of the whole work, was not commenced until July 2d.

The rock at this end, both in the enlargement and in the heading, is harder and more difficult to excavate than that met with either at the east end or the central shaft, having a much larger proportion of quartz mixed with it, and in some places masses of nearly pure quartz have a considerable thickness. The small progress made at the heading, however, is not entirely due to the hardness of the rock. The old pattern of drills, with such modifications as they would admit of, were mainly used until October. Since then drills of improved pattern have been substituted, which give better results.

*Table of Progress at the West End from the recommencement of the work to January 1st, 1870.*

DATES.	TUNNEL EXTENSION.			HEADING EN- LARGEMENT	Total Rock Exca- vated.
	Distance from Portal.	Progress of Heading.	Rock Excavated.	Rock Excavated.	
	<i>Lin. feet.</i>	<i>Lin. feet.</i>	<i>Cub. yds.</i>	<i>Cub. yds.</i>	<i>Cub. yds.</i>
1869. April 5, .	—	—	—	Begun.	—
“ May 1, .	—	—	—	1,279	1,279
“ June 1, .	—	—	—	1,285	1,285
“ July 1, .	4,058	*	*	1,566	1,566
“ August 1, .	4,127	69	410	1,622	2,032
“ September 1, .	4,185	58	295	2,154	2,449
“ October 1, .	4,261	76	448	2,288	2,736
“ November 1, .	4,290	29	148	328	476
“ December 1, .	4,405	115	663	1,399	2,062
1870. January 1, .	4,507	102	766	1,742	2,508
		449	2,730	13,663	16,393
Average per month since July 1st,		74 8-10	455	1,598	2,044
Average required by contract, .		103 1-3	1,744	783	2,527
Work remaining to be done, .		4,751	80,210	39,137	119,347

\* Begun July 2d.

*Brick Arch.*—Work on the brick arch was commenced about April 1st, and progressed satisfactorily, until the rain storm of October 4th, when operations were suspended on account of the tunnel getting filled with water. Work was not resumed again until November 23d.

*Table Showing the Monthly Progress.*

DATES.	Distance from Portal.	Progress, Linear Feet.	No. of Brick laid.
1869. April 1, begun, . . . . .	931	—	—
“ May 1, . . . . .	970	39	82,937
“ June 1, . . . . .	1,007	37	110,595
“ July 1, . . . . .	1,007	37	43,485
“ August 1, . . . . .	1,047	40	125,271
“ September 1, . . . . .	1,089 $\frac{1}{2}$	42 $\frac{1}{2}$	109,633
“ October 1, . . . . .	1,131 $\frac{1}{2}$	42	108,117
“ November 1, . . . . .	1,131 $\frac{1}{2}$	42	15,659
“ December 1, . . . . .	1,131 $\frac{1}{2}$	42	31,317
1870. January 1, . . . . .	1,152	20 $\frac{1}{2}$	64,201
		221	691,215
Work remaining to be done, . . . . .			3,808,785

No rate of progress is specified in the contract for the brick arch. It has only progressed at a rate which will complete it, as far as it is expected to be required, by March 1, 1874. I consider that it would be for the interest of the contractors to put a second force on the work at well No. 4.

In the month of August a soft seam of about 9 feet in thickness was encountered in the east end heading, and another in September at the west end. These seams appear to be mere fractures in the rock filled with soft and loose material, following the general line of stratification. They will each require about 30 feet of arch to be constructed. For the present the roof is supported by timbers. Near the anticlinal axis of the stratification more arching will probably be necessary.

*Central Drain.*—This is being constructed with temporary wooden covering, as provided for in the contract, as fast as the excavation progresses. In blasting for the enlargement of the tunnel portions of the drain already built are frequently injured and will have to be repaired before the permanent stone covering is put in place.

The Haupt tunnel was cleared out, and the timber supports strengthened, in the months of June, July and August, and a rail-track laid through it to facilitate operations at the west end, but the rain-storm of October 4th, broke in about 32 feet of the timber work and filled the tunnel for 78 feet in length, with rocks and gravel. It has again been cleared out and the timber work replaced.

The bridge over the Deerfield River, at the east end of the tunnel, was completed about the latter part of September last, and the contractor commenced, October 28th, hauling rock over it, to form the 2,000 feet of embankment between the river and the present terminus of the railroad. The quantity of embankment required to be made is about 60,000 cubic feet.

*Pneumatic Drills.*—The Improved Burleigh Drills give highly satisfactory results. Their application at the headings, where only a limited number of men can be worked, largely expedites the progress; but I think it is questionable if it is true economy to rely on them for taking out the east end enlargement. On this there is no difficulty in applying as many hand-drilling gangs as may be necessary; and for cubic yards removed I believe it will cost less than by pneumatic drills. Hand drills may be worked continuously, but in using pneumatic drills there will be interruptions from low water and anchor ice, so long as the steam power provided is only sufficient for ventilation and working the headings. Of course it is immaterial to the State whether hand or machine drills are used, provided the contract quantities are taken out monthly. What I object to is delay in removing these quantities in the expectation that eventually this may be accomplished by machine drills.

No gain has been made since the recommencement of the work in bringing up the enlargement at the east end, which is indeed further behind than when the contract was signed. At the date of the contract the amount of rock to be removed between the portal and the advance heading was 32,500 cubic yards, and on January 1, 1870, between the portal and the then heading the amount was 34,012 cubic yards. Should this continue to be the case, when the headings are completed, 16 months' additional time will be required to complete the tunnel,—removing at the rate of 2,166 cubic yards per month, which is the average

amount taken out from all the workings at the east end for the last six months—whereas, the enlargement should be brought up so that it can be completed in three months after the headings unite.

Nitro-glycerine is now used at all the workings, except at the east end heading and the enlargement for the brick arch. At the east end heading the large size of drill used and the system of blasting every four hours does not give time for drilling the holes deep enough to get the full advantage of the nitro-glycerine.

The estimates of the value of work done during the several months, computed at the schedule prices, as returned to the Executive Department, were as follows:—

1869, May	1,	.	.	.	.	\$33,718 42
“ June	1,	.	.	.	.	44,914 53
“ July	1,	.	.	.	.	56,733 94
“ August	1,	.	.	.	.	56,331 58
“ September	1,	.	.	.	.	64,437 90
“ October	1,	.	.	.	.	63,814 71
“ November	1,	.	.	.	.	44,248 00
“ December	1,	.	.	.	.	62,628 47
1870, January	1,	.	.	.	.	65,561 22
						<hr/> \$492,388 77

Averaging for the nine months since the work was commenced \$54,709.86, and for the six months since the contractors received notice to make the rates prescribed in the contract, \$59,503.65; while, to complete the work at the contract time, the estimates from January 1, 1870 must average \$81,920.97 monthly—an amount which, so far, has not been approached within 20 per cent.

Viewing the time already expired as *one year* of the contract time, we find but from one ninth to one-tenth part of the whole work contracted for has been performed, and at the governing points, viz.: the tunnel extension from the east and the west ends, not more than one-fourteenth of the work has been accomplished.

That the progress made falls considerably short of the requirements of the contract and reasonable expectations, is not



due to any unexpected or unforeseen difficulties, but rather to the slowness in commencing the work, and in providing the necessary appliances, labor and material. The only hindrance was a temporary one caused by the rain storm of October 4th, and which affected the west end workings only. But in a work of the exceptional character and magnitude of this, temporary delays, as in the past, may be expected in the future, arising from like causes,—low water, anchor ice, failure of machinery, fire, flood, strikes amongst the workmen, &c.,—besides the unknown obstacles of hard rock, fractures, loose rock, water, &c., which may be found in the bowels of the mountain.

That labor was scarce and difficult to obtain during the summer, there is no doubt, but this may and probably will continue to be the case in the future, so that I think it is unsafe to base any calculation on an unlimited supply, which can only be retained during the whole season by paying a higher rate of wages.

Labor is now plenty, and the main difficulty to be overcome to comply with the terms of the contract is the removal and disposal of the material after it is blasted; and to do this, I think, only requires system and the necessary appliances of transportation. There is no practical difficulty in employing a much larger force than is now worked. By using hand labor in drilling, any desired quantity of rock may be thrown down at convenient places along the 4,000 feet of heading at the east end.

At the Mont Cenis Tunnel an average advance of 240 feet per month is made of completed tunnel at the Bardoneche end, which includes, not only the rock excavation, but also the construction of a brick arch as the work advances. The progress in 1866, as reported by Mr. Latrobe, was 2,667 feet, an average of 222 feet per month, and in 1867 for nine months, the advance was 2,194 feet, being an average of 243 feet per month, the least month's advance being 195 feet, and the greatest 297 feet. Less than one-fifth of the rock was removed by pneumatic drills, the other four-fifths being removed by hand labor. The quantity excavated is 23.9 cubic yards per foot run, which multiplied by 240 feet, gives 5,736 cubic yards of rock taken out monthly, while at the east end of the Hoosac for the six months ending January 1st, the average quantity of rock from the heading enlargements together was only 2,166 cubic yards,

or about  $\frac{5}{13}$  of the quantity taken out from the Bardoneche end of the Mont Cenis Tunnel.

At the west end of the Hoosac the enlargement is gaining on the heading, but this is largely due to the small progress made at the latter, which, during the whole year only amounts to 449 feet linear advance. . .

The distance between the present portals of the tunnel is 4.741 miles. The distance which has been penetrated from the east end, including headings and enlargements is 1.235 miles, and from the west end 0.853 miles—together 2.088 miles—leaving 2.653 miles untouched.

To complete the portion penetrated from the east end to full size tunnel requires, of rock to be removed, 34,038 cubic yards.

From the west end, . . . : . 43,568 “ “

From the untouched portion, . . . . 223,361 “ “

Total, . . . . 300,967 cubic yards.

No portion has been entirely completed, unless we except the brick arch at the west end. At the east end about 2,200 feet in length is nearly to the full size, but there is much loose rock in the bottom, and many projecting points within the lines which still require to be removed.

The following table gives a condensed view of the leading items of work accomplished during the last three years, made up to November 1st of each year, to conform to previous reports:—

Y E A R .	Headings Driven. Lin. Feet.	Tunnel Ex- cavation. Cub. Yards.	SHAFT EXCAVATION.		AGGREGATES.	
			Lin. Feet.	Cub. Yds.	Lin. Feet.	Cub. Yds.
1867,* . .	1,594	14,410	329	2,968	1,923	17,378
1868,† . .	2,082	22,121	75	175	2,157	22,296
1869, . .	1,178	25,013	155	1,821	1,333	26,834

\* In 1867 work was suspended at the west end heading for  $5\frac{1}{2}$  months on account of water.

† In 1868 no work was done on the central shaft, and operations were stopped entirely on the other portions, the appropriation having been expended September 24th, 1868.

The importance of a vigorous prosecution of the work is obvious, when we consider the rapid accumulation of interest on the outlay.

By the time the tunnel and railroad are completed, say March 1st, 1874, the cost, adding compound interest on the disbursements, and deducting value of sinking fund, rents, machinery, buildings, &c., will probably be not less than \$11,000,000, and of this sum, the State, at the time of completion, will be paying interest on \$10,080,000, amounting at five per cent. to \$504,000 annually; and the contractors will be losing interest on \$918,854, the twenty per cent. retained, with accumulated interest of \$118,800,—together, \$1,037,654,—equal at five per cent. to \$51,882 per annum.

For every month, therefore, that the completion of the work is delayed beyond the contract time, interest will be accumulating against the State substantially at \$42,000 per month, and against the contractors at \$4,324 per month,—total, \$46,324 per month; a sum, which, it will be observed, is equal to more than three-fourths of the average monthly estimates of work done for the last six months.

On the other hand, if the work is completed in advance of the contract time, which, notwithstanding the small progress made during the past year, I believe to be perfectly practicable without extra or additional cost, there will result a saving in like amounts per month on the interest and cost of the work.

Respectfully submitted,

JAMES LAURIE,  
*Consulting Engineer.*

BOSTON, February 3d, 1870.

NORTH ADAMS, February 15, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of January, was as follows:—

East end heading advanced, . . . . .	123 feet.
West end heading advanced, . . . . .	79 “
Central shaft sunk, . . . . .	29 “

The amount of the estimate for the month, as made out by Mr. Frost, is \$68,323.84.

The pneumatic drills used at the west end heading were the latest production of the manufacturers, and were supposed to embrace many improvements on those used at the east end, but they proved defective, breaking quite frequently, and on January 23d hand labor was substituted, so as to afford an opportunity to make alterations on the drills.

The detailed statement of quantities of work to be done March 1st, 1869, to complete the tunnel, which I referred to when in Boston, has not been furnished.

For six months I have been trying to get this statement, but in vain.

Having been repeatedly informed by Mr. Frost that the schedule quantities were correct—that they were estimated by two separate parties, who agreed in their calculations, but that he had lost or destroyed the notes—that he had re-measured the work and that the new calculations agreed almost exactly with those formerly made.

Notwithstanding these statements, I became convinced that there were serious blunders and discrepancies which he was trying to hide and cover up; and finding him allowing full measurement for uncompleted work, allowing for work not done during the month, and allowing for work not in the schedule at all, I felt, in justice to the State, to the contractors and to myself, that until furnished with detailed calculations, recorded in such manner as to allow of verification, I could not approve of his estimates.



He admits that he has all the data on hand, and nothing more is required than to copy or engross the calculations already made.

On my arrival here last week he expressed his determination not to furnish the quantities in detail, but on my stating that I would advise the governor and council to send some one up to make them out, he intimated that he would furnish them, and has gone to work revising and re-calculating once ~~once~~ more. Under these circumstances, I do not sign the present estimate. This matter has already been delayed too long, and should be straightened out while the necessary data are accessible.

I will remain here a few days and endeavor to get the information wanted. I know of nothing actually wrong in the present estimate, except as to the continuation of items referred to in my letters of January 14th and 21st.

It is desirable, now that the contractors will rely mainly on the money furnished by the State, that the estimates should be in Boston on or before the 15th of each month, and I have endeavored to get Mr. Frost to complete them by the 10th, but he rarely gets through with them until the 13th or 14th of the month, which does not allow time for much examination.

The present estimate was only received yesterday afternoon. Annexed is a copy of a note handed to Mr. Frost on January 19th.

Very respectfully,

Your obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

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NORTH ADAMS, January 19, 1870.

BENJ. D. FROST, Esq., *Supt'g Eng'r, &c.*

DEAR SIR:—The estimates of quantities which you promised on Monday to have ready by the 1st of next month, I wish you to forward to my address at Hartford, in tabular statement as per form furnished you. It has been apparent to me for several months that you do not wish to furnish these estimates; but as I consider them necessary for an intelligent performance

of the duties assigned me, and knowing from an inspection of the cross-sections that it will require only a short time to make them out—your own estimate last week being two to three days—I hope that there will be no further delay.

Yours truly,

JAMES LAURIE.

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NORTH ADAMS, March 19, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR :—The following progress was made at the Hoosac Tunnel during the month of February :—

East end heading advanced	.	.	.	.	109 feet.
West end heading	"	.	.	.	63 "
Central shaft sunk	.	.	.	.	27 "

At the east end heading work was interrupted during the month about one and a half days by anchor ice. At the west end heading, the small progress made was due to the work having been prosecuted, from January 23d until February 21st, by hand drilling. On the latter date a sufficient number of pneumatic drills to begin with, had been altered, and they were again put in operation. They are reported to be working well.

The estimate for the month amounts to \$58,530.01, showing a large falling off from previous months, which is partly accounted for by deductions having been made for rock allowed in previous estimates by Mr. Frost, although not taken out.

On February 1st, the number of men employed on the work was 593, and on March 1st 689.

On the 9th instant I was furnished with revised calculations of a portion of the work contracted for by the Messrs. Shanly, and remaining to be done March 1st, 1869. Despairing of obtaining the estimates of the other portions from Mr. Frost, I have calculated them myself, and submit the following tabular statement :—

## HOOSAC TUNNEL.

*Comparison of the Schedule Quantities of Work remaining to be done March 1st, 1869, with Revised Calculations of the same Work March, 1870.*

	Schedule	REVISED CALCULATIONS.		DIFFERENCES.	
	Quantities.	Solid Rock.	Loose Rock.	Solid Rock.	Loose Rock.
<i>East End Section.</i>					
Tunnel Enlargement (Frost),	<i>Cub. yds.</i> 4,500	<i>Cub. yds.</i> 3,948.04	<i>Cub. yds.</i> 2,252.33	<i>Cub. yds.</i> —551.96	<i>Cub. yds.</i> +2,252.33
Heading Enlargemen (Frost),	28,000	28,483.36	1,832.90	+483.36	+1,832.90
Tunnel Extension (Laurie), .	85,100	85,442.00	—	+342.00	—
<i>Central Section.</i>					
Tunnel Extension East (Lau- rie), . . . . .	35,409	35,554	—	+145.00	—
Tunnel Extension West (Lau- rie), . . . . .	46,861	47,053	—	+192.00	—
<i>West End Section.</i>					
Tunnel Extension (Laurie), .	82,940	83,280	—	+340.00	—
Heading Enlargement (Frost),	—	50,237.35	428.09	—2,562.65	+428.09
Do. additional excavation re- quired to use 4½ millions brick (Laurie), . . . . .	} 52,800 {	2,028.63	—	+2,028.63	—
To enlarge bottom of Central and West Shafts for grat- ings, &c., 600—233 = 337 (Laurie), . . . . .		377.00	—	+377.00	—
	335,610	336,403.38	4,513.32	+793.38	+4,513.32

The loose rock in the above table is rock that had been blasted by the Commonwealth, but not removed from the tunnel. In the contract no mention is made of loose rock, and Mr. Frost professes he does not recollect whether it was included or omitted in making up the schedule quantities. Estimating the above quantities (differences) at the schedule prices, we get \$63,000 in addition to the contract sum. But to allow full price for the loose rock, unless it was understood at the time of making the contract, would scarcely be equity, the State paying twice for excavating the same rock.

At the arbitrary prices allowed in the monthly estimates for rock not removed by the contractors, the excess would be reduced to about \$14,000, but in these monthly estimates Mr. Frost has allowed full price at the west end heading enlargement, where there was about 305 cubic yards of loose rock left by the State, and the only place where any great amount has so far been removed by the contractors.

Mr. Frost, last month, for the first time, stated that there was an understanding on his part, and between the members of the council and the contractors, that a large amount of material was not to be removed from the tunnel (in other words, that the size of the tunnel was to be reduced), but knowing that his representations heretofore in relation to the work and his estimates of quantities have not been very reliable, I have little faith in the statement.

The revised estimate of the work done by Messrs. Shanly, promised to be ready on the 11th instant has not been furnished.

Very respectfully, your most obedient servant,

JAMES LAURIE, *Consulting Engineer.*

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The following progress was made at the Hoosac Tunnel during the month of March:—

East end heading advanced,	.	.	.	.	110 feet.
West end heading advanced,	.	.	.	.	105 "
Central shaft sunk,	.	.	.	.	30 $\frac{1}{2}$ "

The amount of the estimates for the month, as made out by Mr. Frost, is \$71,055.90.

On March 30th, at the west end, 23 $\frac{1}{2}$  feet in length of excavation, which had been made preparatory to turning the brick arch, was filled up by the breaking down of the roof, caused by blasting and the want of sufficient timber supports. At the same time, the adjoining section of 24 feet of brick arch, which had just been completed, was crushed down. This is a rather serious mishap. Great care will be required in removing the material and supporting the roof while the brick arch is being replaced, which I have recommended be made three feet in thickness in the failed part. The drainage from the tunnel is now partially stopped by the fallen material, the water being dammed four feet in height, and there is some danger that the channel may get entirely blocked up. If this should hap-



pen, all the workings west of the west shaft will have to be suspended until the water can be drawn off by cutting a drift through the fallen rock. Operations to repair damages were only commenced on the 11th inst., the men being timid about going to the work, which certainly is not unattended with risk.

In the present estimate there has been deducted about \$3,000 for rock from the west end heading, which had been excavated and paid for by the State, but not removed from the tunnel, which I found in January last had been allowed to the contractors, commencing in June last at full price, as if executed by them.

The excavation made for the brick arch, which has been filled up by the falling of the roof, amounting to 1,200 to 1,400 cubic yards, has been allowed as completed work. It will have again to be excavated, and when this is done the allowance will disappear.

I also find that in May last the contractors were allowed and paid for about 1,000 feet of central drain excavation at the west end, amounting to about \$3,000, where the State had excavated the solid rock to the full depth required. The reason now given by Mr. Frost for including it is, that there was some loose rock in the bottom, and that it formed part of the schedule quantity. As the contractors claim to be paid extra for all work not in the schedule, I think in equity that this should at least offset the \$1,842 allowed at the east end in December for similar work not being in the schedule; but both allowances are continued in the present estimate.

The brook channel, which gave way in October last, is needing repairs; and Mr. Frost informs me that the contractors have notified him that it is at the risk of the State. I have advised him to give them official notice that the State has no responsibility in the matter,—that it is entirely at the risk of the contractors, who by the contract are bound to maintain in thorough repair all “accessory” works. In fact, had the channel been kept clear and in proper repair, there would have been no damage in October last.

Very respectfully, your most obedient servant,

JAMES LAURIE, *Consulting Engineer.*

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—I have received a copy of the order in council dated April 22, 1870, by which the secretary of the Commonwealth is directed to forward to me the last estimate of Mr. Frost for work performed on the Hoosac Tunnel for my approval, or for me to give the governor and council reasons for withdrawing the same.

In reply I beg leave to say, that in my letter dated April 15th, forwarding the estimate, I stated that having only received it that afternoon there was not time to examine it, but that I would proceed to do so and forward a report in a few days.

This report was forwarded April 21st and to which I beg leave to refer you.

By the contract entered into with the Messrs. Shanly the Commonwealth agreed that they would "pay to the contractors on or before the 15th day of each month following the performance of the work, 80 per cent. of the amount of money earned by them, as ascertained and shown by the certificates of the engineer or engineers"; and, being aware that the non-fulfilment of this condition would much inconvenience the contractors, and in the case of a private company would induce claims to be made for a breach of contract, I endeavored to get Mr. Frost to have the estimates ready for examination by the 10th of each month, or at all events so that I could have several days for their verification. But since November no estimate has been ready until the 14th or 15th of the month; and there was presented the alternative of either forwarding them without examination, or of retaining them for several days beyond the time specified in the contract for the monthly payments.

I was induced to this course [from discovering that I had been approving unfair estimates, to use a mild term, from the beginning,—estimates authorizing the paying the contractors for work that had already been paid for by the Commonwealth; paying them for work in advance of its execution, and paying them full price for incompleated work.

But to return to the last estimate.

1. On examining into its details I found that of the 704 cubic yards which had been allowed to the contractors for work not done, commencing 12 months ago, which was deducted as loose rock in March, although Mr. Frost admitted at the meeting of council April 6th that part was solid rock, is still continued as in the March estimate without deduction.

2. That some \$3,000 had been allowed the contractors for central drain excavation at the west end, where the Commonwealth had excavated the solid rock to the full depth required. Information had been asked on this point April 13th, but was not obtained until the 16th.

In the first of these cases the contractors are allowed for work not executed, and in the second they are allowed for work which the Commonwealth had already paid for.

3. The excavation made for the brick arch, filled up by the falling in of the roof, amounting to 1,200 or 1,400 cubic yards, and of the value of about \$10,000, has been allowed as completed work.

In connection with this item it may be proper to state that the estimate as received from Mr. Frost was mailed by me on the afternoon of the 15th inst., and on the following day, the 16th, about 11 A. M., he informed me that he had the previous night seen the postmaster and induced him not to forward my letter enclosing the estimate,—that he had made out a new estimate omitting the work destroyed at the brick arch, and wished me to withdraw the former. Considering this an unjustifiable interference on the part of Mr. Frost and the postmaster, I declined to withdraw it, informing him that if he wished to substitute another estimate to forward it to Boston with any explanation that he thought proper,—that I had not been called upon, and would not then express an opinion on the subject, but that I would examine into the whole merits of the case.

The matter appears to stand thus: One clause of the contract specifies that "Estimates will be based upon the quantity of material which lies within the line of section prescribed by the engineer or engineers, and any material falling from the outside of these lines, whether detached by blasts or falls, must be removed by the contractors without charge."



And another clause specifies that the contractors are to be paid monthly "Eighty per cent., of the amount of money earned by them." And the question arises whether under the contract they are entitled to be paid for work, which, after having been performed, has failed, and has to be done over again at an increased cost,—whether it can, on its failure, be considered work on which money has been earned by the contractors.

My opinion is, that under the circumstances, where the work is immediately to be rebuilt, a liberal construction of the contract is justifiable, but I would prefer to have the opinion of counsel as to the rights of the parties in the matter.

So far the questions involved in the approval or non-approval of the estimates are very simple. Mr. Frost has included in the estimates work that had already been performed and paid for by the Commonwealth; allowed full estimates for incomplete work; also allowed for work in advance of its execution. These cover most of the cases raised, apart from the questions arising from differences between the schedule quantities and the revised estimates.

The allowances above referred to I consider wrong in themselves, and that they cannot be justified. To say that making allowances in the first and second cases above mentioned is only a difference in the manner of making the estimates; that such allowances can be deducted four or five years hence on the completion of the work, by the then officers of the government, is to say what all experience shows cannot be effected. The very fact that they were made and approved will be the effective reason urged why they should not be deducted, or the contractors called upon to complete the work according to contract. I doubt if there is a single instance in all the experience of the Commonwealth with the Hoosac Tunnel and railroad, where such allowances once made were ever withheld.

If it is right to make them, it is right for the government to authorize them to be made; but to do so would raise insuperable difficulties; the contract is in the way, and how and where is the limit to be put.

In the case of "clearing out and maintaining the Haupt tunnel," assume that the whole amount agreed upon had been paid to the contractors, and that the tunnel gets filled up again; they would at once claim that they had performed the work and



received pay for it ; that if they cleared it out again they must again be paid.

In the tunnel and central shaft, every cubic yard which the contractors leave, expecting that they will not be called upon to remove, will cost at least five times more than if removed in the first instance, and they already intimate that they expect to be paid in full, although the work may not be completed to the full dimensions.

To require a consulting engineer to approve of estimates is not in accordance with usual practice, he having no control or direction in preparing them, other than advisory, when asked. That is the business of the engineer in charge, and it is to be presumed that his employers have confidence in his judgment and integrity, and his certificate alone is ordinarily considered sufficient.

Although I believe the allowances above specified are now reduced to a comparatively small amount, still, until the principle is established and acted upon of not making them at all, I cannot approve of the estimates ; and therefore return that for last month without my signature, and present this communication, as I have my monthly reports since December last, as giving my reasons therefor.

Very respectfully, your most obedient servant,

JAMES LAURIE, *Consulting Engineer.*

HARTFORD, April 25, 1870.

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NORTH ADAMS, May 16, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The following is the progress made at the Hoosac Tunnel during the month of April:—

East end heading advanced,	. . . . .	121 feet.
West end heading advanced,	. . . . .	100 “
Central shaft sunk,	. . . . .	35½ “

The estimate for the month amounts to \$69,817.97.

About twenty-five feet of the brick arch which was crushed down by the falling in of the rock roof on March 30th, has been rebuilt. The progress is necessarily slow from the necessity of supporting the great mass of loose material above. It will require until some time in June to get past the failed part. From the various delays which have taken place, and the possibility of more occurring, it is very desirable that another gang should be put on the brickwork, as recommended in my annual report. At the average progress made since 1st of July last, with one gang, 48 months will be required to complete the work.

The central shaft, by the contract, was to be down to grade by May 1st. There still remains 110 feet to be sunk, which, at the average progress made during the last three months, will require until the middle of August, or  $3\frac{1}{2}$  months beyond the contract time.

The solid rock remaining in the brick arch, which had been allowed to the contractors by Mr. Frost, has been deducted; also \$2,115 allowed them for central drain excavation, which had been done and paid for by the Commonwealth.

The statement of quantities by the revised calculations for the whole work, so often referred to, has not as yet been furnished by Mr. Frost.

Very respectfully,

Your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

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NORTH ADAMS, June 14, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR,—The following progress was made at the Hoosac Tunnel during the month of May:—

East end heading advanced,	. . . . .	135 feet.
West end heading advanced,	. . . . .	79 “
Central shaft sunk,	. . . . .	29 “

The estimate amounts to \$61,467.91, being rather less than three-fourths of the average amount required monthly to complete the work at the contract time.

The small progress made at the west end was partly due to experiments being made with the new explosive, *dualin*, and in part to working only six pneumatic drills. It is claimed that the carriage at this end is of too light construction to work the eight drills required by the contract. Generally only six have been worked. The rock is now favorable, and as this is the governing section for the speedy completion of the work it is very desirable that arrangements should be made for another carriage, the present one to be transferred to the easterly workings from the central shaft.

During the month four days were lost at the central shaft by the breakage of a part of the hoisting machinery; otherwise the work has progressed satisfactorily.

At the meeting of council held April 6th, I stated on the authority of Mr. Frost, who was present, in reply to inquiries made, that the lines run by him agreed to within  $\frac{1}{4}$  or  $\frac{1}{2}$  inch of those run by Mr. Doane. Having discovered this to be incorrect I annex a copy of a letter on the subject, which perhaps sufficiently indicates the present unsatisfactory engineering condition of the line, and which I find there has been little progress made in correcting during the past month.

Very respectfully, your most ob't servant,

JAMES LAURIE, *Consulting Engineer.*

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[Copy.]

NEW YORK, May 26, 1870.

BENJ. D. FROST, Esq., &c., &c.

DEAR SIR:—From the statements made at various times, that the lines run by you did not vary more than  $\frac{1}{4}$  or  $\frac{1}{2}$  inch from Mr. Doane's lines, or those staked out by your predecessor, I was surprised to find on my last visit that no attention had been paid to the initial point established on the stone pier at the east end; that you had never in fact been to the observatories or signal stations east of the Deerfield on the two summits of the



Hoosac, the only point from which the line can be properly verified or run. I have no doubt that the mark on the stone pier, inside the signal-house at the east end, is Mr. Doane's initial point, and that from which the tunnel had been worked previous to your connection with it, and to save additional work and make the lines unite, it is the point to start from. By varying from it three inches, as in your trial of the 15th instant, will, assuming Mr. Doane's line correct (and which from my observations that day I think will probably be found to be the case), make a variation at the central shaft of about twenty inches, or half that sum if you vary from the point  $1\frac{1}{2}$  inches.

If the transit instrument is out of adjustment as you claimed, it ought to be sent to Boston at once.

The surface line should be first tested, by placing the instrument on Mr. Doane's point east of the Deerfield and continuing the line west and establishing a point near to the central shaft.

The same process should be gone through with from the west end station, testing the initial points at both ends. When this surface line is found to be correct, the underground should be run in from both ends to correspond therewith. I would recommend that the points inside the tunnel be first established on the timber covering of central drain, say at distances about 1,000 feet apart, which point can be readily transferred by a plumb bob to the roof of the tunnel. In this way the line may be run, even if there is some smoke in the tunnel.

For the surface work there probably will not at this season, from the great aberration of light in hot weather be more than ten or twelve days during the next two months suitable for accurate observations, and then only for about two hours after sunrise; while the underground operations can only be satisfactorily performed on Sunday afternoons, when the tunnel is comparatively clear from smoke.

Mr. Doane, I understand, was engaged most of a whole season in establishing the line, and as he appears to have understood what was really required, and his work and station points bear evidence of intelligent purpose and correctness I would not put them aside until they are proved to be wrong.

The central shaft, from the progress making, ought to be down to the top of the tunnel in about two months from this date, and the levels over the mountain to some fixed point near



the shaft, should at once be accurately taken and compared with the former levels. If they agree, good and well; if not, they must be repeated until they are found to correspond.

I hope you notified the *contractors* that at the east end heading they were above grade. In April last, Mr. F. Shanly stated that he would keep down to grade if duly notified. The profile shows that not more than about one-half of their work, including east and west end workings, is down to the proper level. It will cost at least five times more per cubic yard to take it out afterwards, than if done in the first instance.

Yours, &c.,

JAMES LAURIE, *Consulting Engineer.*

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HARTFORD, July 15, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of June was as follows:—

East end heading advanced,	.	.	.	.	142 feet.
West end heading advanced,	.	.	.	.	80 "
Central shaft sunk,	.	.	.	.	38 "
Amount of estimate, \$73,567.03.					

The force employed on the work has been increased to 704 men.

At the west end heading a mass of very hard rock was encountered, which delayed progress during the last half of the month. The central shaft on July first, was down to within 43 feet of grade line—the month's work being the greatest by  $2\frac{1}{2}$  feet since the commencement.

The brick arch, under the failed portion of the roof at the west end, was completed during the month with the exception of about 7 feet. No further trouble was anticipated.

On the first of July, 12 months had elapsed since the contractors received notice to make the progress, on the several

sections, specified in the contract. The average of the estimates during this period has been \$63,315.38, the highest for for any one month being the present estimate of \$73,567.03. To complete the work at the contract time, requires that the estimates from the first of the present month shall average \$83,882.49.

The definite measurements of the work, which I have been endeavoring for nearly 12 months to obtain, have not yet been furnished. In April last Mr. Frost furnished a statement bearing on its face that it was in accordance with plans of the consulting engineer, but having neither made out or approved of any plans in this connection, I requested him,—per annexed letter,—to furnish a statement of work to be done by the contractors under the contract, which, however, remains unanswered.

In the statement furnished by Mr. Frost, he makes the quantity of solid rock exceed that in my report of March 19th, 1870, about 560 cubic yards, of the additional value of about \$5,600.

At the meeting of the executive council held April 6th, Mr. Frost stated that there was a large amount of loose rock within the lines of the tunnel, which had been omitted, unknown to the contractors, in making up the schedule quantities; also that the quantities of solid rock, under a misapprehension, were calculated at a less than the true sectional area of the tunnel; and that he had destroyed the original notes and estimates on which the schedule quantities were based, to prevent the contractors from making or establishing any claim for the work so omitted.

As I cannot be a party to any deception or cheating of this kind, and to get rid of the subject so far as I am concerned, I feel it but just that the facts should be communicated to the contractors, which I would have done ere this, had it not been for the purpose of giving opportunity to the officers of the State to make any necessary arrangements in the matter. I consider, since I am asked to approve of the estimates, that it is as much my duty to protect the rights of the contractors as of the State, and on the same principles that led me to expose the paying of the contractors for work which had already been performed and paid for by the State, which was simply a convey-

ance of money from the treasury of the State into the pockets of the contractors without any equivalent, as such payments would not eventually count on their contract work.

Very respectfully,  
Your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

"HARTFORD, May 9, 1870.

"BENJ. D. FROST, Esq., &c., &c.

"DEAR SIR:—The statement handed me on leaving North Adams, I observe, professes to be a comparison of the estimated quantities for contract, with revised calculations on plans proposed by me. Having made out no plans nor approved of any, I prefer you make your calculations on your own plans, and will therefore thank you to make out a statement based on the revised calculations,—the first having been incorrect,—showing the amount of work required on the several sections, specifying the amounts that you consider the contractors can be called on to perform for the contract sum." \* \* \* \*

"Yours, &c.,

J. L."

NORTH ADAMS, August 14, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR Sir,—The progress made at the Hoosac Tunnel during the month of July was as follows:—

East end heading advanced,	.	.	.	.	.	132 feet.
West end heading advanced,	.	.	.	.	.	97 "
Central shaft sunk,	.	.	.	.	.	32 "

The headings of the tunnel, east and west from the central shaft, have each been extended  $2\frac{1}{2}$  feet beyond the outer lines of the shaft.



The estimate for the month amounts to \$74,759.23. The number of men employed on the work August 1 was 759, being 66 more than on June 1, and 55 more than on July 1.

At the east end heading work was interrupted for about two days during the month by low water in the Deerfield River, and by breakage of the air-pipes. From the 27th to the 31st the water was quite low, and steam-power was used for working the pneumatic drills. The recent rains have supplied the streams, and at present there is abundance of water.

The rock at the west end heading has been quite variable during the month. At the present time it is pretty hard.

But small progress has been made at the brick arch, a small gang only having been employed. At the rate of advance made for the last six months, which includes the delay by the breaking down of the roof, seven years will be required to complete the arch.

The central shaft was supposed to be down to within 11 feet of the floor of the tunnel on the 1st of August, and it is probably now down to that long-desired point, but reliable levels have not yet been taken over the mountain. They have only been completed from the west end of the tunnel to the shaft, but unfortunately do not agree with former notes, there being a discrepancy of  $5\frac{1}{4}$  inches. The series of levels from the east end have only recently been commenced.

The delay in having these levels taken is much to be regretted, as the contractors must work at a disadvantage until the precise position of the tunnel is established, while by the contract the Commonwealth is liable for all extra work that may in consequence have to be performed by the contractors.

I have made inquiry of Mr. Frost in relation to the reported insufficient size of the shaft to pass the buckets down on the side which has not heretofore been used. He professes to have had notes taken since December last, but cannot produce them, or tell when they were taken, who took them, or what point or place in the shaft—whether one, two, or three hundred feet down—the projections occur. I have recommended that notes be taken at once.

I received Councillor Adams' letter, dated July 29, requesting that I should defer communicating to the Messrs. Shanly the fact that some portions of the work required to be done at the



tunnel had been omitted in the schedule of quantities furnished them until opportunity was afforded of questioning Mr. Frost further upon the subject.

Very respectfully, your most obedient servant,

JAMES LAURIE, *Consulting Engineer.*

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NORTH ADAMS, September 13, 1870.

HIS EXCELLENCY WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The following progress was made at the Hoosac Tunnel during the month of August:—

East end heading advanced,	. . . . .	150	feet.
West end heading,	. . . . .	112	"
Central shaft sunk	. . . . .	9	"
Central shaft heading, east,	. . . . .	2 $\frac{1}{2}$	"
Central shaft heading, west,	. . . . .	2 $\frac{1}{2}$	"

Estimate for the month, \$72,085.06.

Good progress, it will be observed, was made at the east and the west end headings.

During the month the water in the Deerfield River was frequently quite low, and the steam compressors at the east end were used for about thirteen days in aid or auxiliary to the turbine compressors.

The central shaft was supposed to be down to grade on August 13, and since that date the contractors have been occupied in trimming the shaft, which is not yet quite completed, and in strengthening the timber-work preparatory to continuing the headings east and west from the bottom of the shaft. Some time will be required to make necessary repairs on the hoisting engine and machinery, which may delay the commencement of work until about the 5th or 10th of October.

The following table exhibits the *actual progress* made in linear feet of tunnel heading from July 1, 1869, to September

1. 1870, also the *progress required by contract* during the same period, embracing fourteen months from the time the contractors received notice to make the advance specified in the contract.

*Progress of Headings from July 1st, 1869, to September 1st, 1870.*

SECTION.	Actual Progress.	Progress required by Contract.
East End Section, . . . . .	1,850 feet.	1,750 ft.
West End Section, . . . . .	1,164 "	1,400 "
Central Section, . . . . .	5 "	E. 240 } 480 " W. 240 }
Actual progress less than required by contract, . . . . .	3,019 feet. 811 "	3,630 ft.

Showing that the actual advance of all the headings is only about 83 per cent. of the contract requirements, while at the west end and the central shaft heading towards the west (which are the governing points for the speedy completion of the work) only 71 per cent. of the progress required by the contract has been made.

The levels necessary to determine the exact grade line at the bottom of the shaft have not as yet been completed.

Very respectfully, your most obedient servant,

JAMES LAURIE, *Consulting Engineer.*

(Now see Reports in No 330)

To His Excellency the Governor and the Honorable the Executive Council of the Commonwealth of Massachusetts.

I respectfully submit the following report, showing the progress made during the past year in the construction of the Hoosac Tunnel. The monthly reports which I have presented of the condition and progress of the work will render it unnecessary to give more than a *résumé* of the year's proceedings, together with the tabular statements of the work performed.

*East End Section.*

On this section the work has progressed satisfactorily, no unexpected or unforeseen difficulties have occurred, and the progress required by the contract has been exceeded on the average by about  $1\frac{1}{4}$  feet per month.

The rock has been of a very uniform and favorable character, and no springs of water of any magnitude have been met with to interfere with the economical prosecution of the work.

The steam compressors which the contractors erected have rendered them in a great measure independent of low water in the Deerfield River, of which during the past season there was a considerable period, the steam compressors having been used more or less during the months of July, August and September, and it is to be hoped that they will also in the future prevent delays and interruptions to the progress of the work from anchor ice.

About one-third of the planking on the aprons of the dam was knocked off by the ice during the spring freshets of 1870. This was renewed by the contractors in September last. The canal embankment was also strengthened where it had suffered injury.

The following table exhibits the monthly progress during the year on the several workings of east end section, appended to which (as also to subsequent tables of progress) is a comparative statement showing the average amount of work performed monthly ; also the average amount required to be performed to complete the work at the contract time, together with a statement of the work remaining to be done.

Table of Progress, East End Section.

D A T E.	TUNNEL EXTENSION.			Heading Enlarge- ment. Cubic Yards.	Tunnel Enlargement. Cubic Yards.	Total Rock Excavated. Cubic Yards.
	Distance from Portal. Linear Feet.	Progress of Heading. Linear Feet.	Rock Excavated. Cubic Yards.			
1870—January 1, . . . . .	6,522	—	—	—	—	—
February 1, . . . . .	6,645	123	834	1,358	327	2,513
March 1, . . . . .	6,754	109	701	1,067	283	2,054
April 1, . . . . .	6,864	110	1,744	1,183	47	2,974
May 1, . . . . .	6,985	121	2,060	1,254	—	3,314
June 1, . . . . .	7,120	135	1,792	1,398	—	3,190
July 1, . . . . .	7,262	142	2,093	1,305	—	3,398
August 1, . . . . .	7,385	123	1,882	924	—	2,806
September 1, . . . . .	7,535	150	1,947	1,151	—	3,098
October 1, . . . . .	7,661	126	1,119	1,971	—	3,090
November 1, . . . . .	7,788	127	1,260	1,602	—	2,862
December 1, . . . . .	7,921	133	1,109	2,709	—	3,818
1871—January 1, . . . . .	8,036	115	848	1,610	—	2,458
	—	1,514	17,389	17,532	657	35,575*
Average per month during the year, . . . . .		126½	1,449	1,461	55	2,965
Average per month required to complete work at contract time, . . . . .		117¼	2,337	246	41	2,624
Work remaining to be done, . . . . .		2,582	58,436	4,672	664	63,775

\* Of this quantity 3,226 cubic yards remain in the tunnel as loose rock.



*Central Section.*

*Central Shaft.*—By the contract the central shaft was to be sunk to grade by May 1st, 1870, and the headings commenced by June 1, but it was not until August 13th that grade was reached, and the headings practically were not commenced until October 25th, being  $4\frac{5}{6}$  months beyond the contract time. This falling behind was mainly due to delay in commencing the work, the actual sinking not having been begun until May 20th, 1869.

*Table of Progress.*

DATES.	Progress in Feet.	Total Depth in Feet.
Depth sunk by Commonwealth, 1864-7, . . . . .	—	583
Depth sunk by W. & F. Shanly, from May 20, 1869, to January 1, 1870, . . . . .	—	215
1870 February 1, . . . . .	29	—
“ March 1, . . . . .	27	—
“ April 1, . . . . .	$30\frac{1}{2}$	—
“ May 1, . . . . .	$35\frac{1}{2}$	—
“ June 1, . . . . .	29	—
“ July 1, . . . . .	38	—
“ August 1, . . . . .	32	—
“ August 13, . . . . .	9	—
		230
Total depth of Shaft, . . . . .		1,028

The progress made during the  $7\frac{1}{2}$  months, from January 1st to August 13th, 1870, it will be observed, was 230 feet, which is a greater progress than was made during any previous year since the commencement of the work.

The yearly progress in sinking was as follows:—

1864, working	5 months, . . . . .	70.7 feet.
1865, “	10 “ . . . . .	161.8 “
1866, “	9 “ . . . . .	160.5 “
1867, “	10 “ . . . . .	190.0 “
1868, “	0 “ . . . . .	0.0 “
1869, “	$7\frac{1}{2}$ “ . . . . .	215.0 “
1870, “	$7\frac{1}{2}$ “ . . . . .	230.0 “
	49 months, . . . . .	1,028.0 feet.

Averaging 21 feet per working month.

The increased progress made in 1869 and 1870 was due to the use of nitro-glycerine, and the better management of the work.

*Tunnel Extension from Central Shaft.*

Considerable delay occurred after the shaft had reached bottom before commencing the headings. The material from the shaft had been hoisted in buckets containing about one cubic yard, through one of the four well-holes which the plan of the shaft provides for; but it was necessary, from the larger quantity of material to be hoisted from the headings, to make arrangements for using two of these well-holes, and the shaft not having been excavated true to its full dimensions, considerable trimming was found necessary to admit of the *cages*, in which the cars containing about three cubic yards of material are to be brought up. Nearly two and a half months were occupied on this work and in repairing the hoisting engine and machinery, so that the excavation of the headings (excepting for two and a half feet on each side, which was taken out by enlarging the shaft through the height of the tunnel), was not commenced until October 25th.

The work, so far, has been prosecuted by hand-labor, and will continue to be so until the headings get about 300 feet apart, when the contractors intend to put pneumatic drills in operation in the westerly heading.

On December 8th, some of the gearing of the hoisting machinery failed, compelling a suspension of work, and it was not until January 3d that operations were again resumed.

There has been a considerable increase of water since the headings from the bottom of the shaft have been prosecuted, especially in the west heading, so that there is now about gallons raised from the bottom in twenty-four hours which is fully 50 per cent. increase on the quantity raised before the headings were commenced. Should the increase continue as the headings extend, it will soon become necessary to provide additional pumping power.

## TABLE OF PROGRESS.

*Tunnel Extension going East from Central Shaft.*

DATE.	Distance from East Portal. Linear Feet.	Progress of Heading. Linear Feet.	Rock Excavated. Cubic Yards.
	128.37	Centre of Shaft,	—
1870—August 13, . . .	128.21	16.0	144
October 25, . . .	128.21	Begun.	—
November 1, . . .	128.17½	3.5	24
December 1, . . .	127.87	30.5	172
1871—January 1, . . .	127.77	10.0	55
		60.0	395
Average per month required to complete work at contract time, . . . . .			
		103	1,667
Work remaining to be done, . . . . .			
		2,160	35,014

*Tunnel Extension going West from Central Shaft.*

DATE.	Distance from West Portal. Linear Feet.	Progress of Heading. Linear Feet.	Rock Excavated. Cubic Yards.
	121.94	Centre of Shaft.	—
1870—August 13, . . .	121.78	16.0	144
October 25, . . .	121.78	Begun.	—
November 1, . . .	121.68½	9.5	69
December 1, . . .	121.23	45.5	268
1871—January 1, . . .	121.07	16.0	96
		87.0	577
Average per month required to complete work at contract time, . . . . .			
		95.0	1,542
Work remaining to be done, . . . . .			
		2,851.0	46,284

*West End Section.*

During the past year the contract requirements have, on the average, substantially been accomplished, but the falling behind of the previous year has not been made up.

The rock on this section has been generally more hard and variable in character than on the others, although during the last three months it has materially improved.

Until October, 1869, the old patterns of pneumatic drills were used, and when new ones were obtained they were found want-

ing in strength and durability, so that it became necessary on January 23d, 1870, to suspend using them to make alterations and strengthen them, the work on the heading meanwhile, for one month, being prosecuted by hand labor. Since the alterations were made the drills have worked more satisfactorily.

The drill-carriage in use at this end is of rather light construction, so that it has been found that only six or seven drills can advantageously be worked, while the contract requires that not less than eight shall be maintained.

In June last I suggested that the carriage at this heading should be transferred to the east end working from the central shaft, which will be completed much in advance of the others, and that one of the new carriages be substituted in its place. To make the transfer need not occupy more than two days.

As this is one of the governing sections for the speedy completion of the work, it is very desirable that every proper means should be used to carry it through expeditiously.

*Table of Progress at the West End for the 12 months ending January 1st, 1871.*

DATE.	TUNNEL EXTENSION.			HEADING ENLARGEM'T.	Total Rock Excavated.
	Distance from Portal.	Progress of Heading.	Rock Excavated.	Rock Excavated.	
	<i>Lin. feet.</i>	<i>Lin. feet.</i>	<i>Cub. yds.</i>	<i>Cub. yds.</i>	<i>Cub. yds.</i>
1870. January 1, .	4,507	—	—	—	—
" February 1, .	4,586	79	1,617	847	2,464
" March 1, .	4,649	63	1,333	839	2,172
" April 1, .	4,754	105	1,706	488	2,194
" May 1, .	4,854	100	1,738	251	1,989
" June 1, .	4,933	79	1,327	44	1,371
" July 1, .	5,013	80	1,675	219	1,894
" August 1, .	5,110	97	1,825	841	2,666
" September 1, .	5,222	112	1,824	1,076	2,900
" October 1, .	5,325	103	1,515	1,390	2,905
" November 1, .	5,450	125	1,760	925	2,685
" December 1, .	5,580	130	1,675	749	2,424
1871. January 1, .	5,710	130	1,897	813	2,710
	—	1,203	19,892	8,482	28,374*
Average per month during the year, . . . . .		100½	1,652	707	2,365
Average per month required to complete work at contract time, . . . . .		104½	1,774	806	2,580
Work remaining to be done, . . . . .		3,548	60,318	30,655	90,973

\* Of this quantity 1,614 cubic yards remain in the tunnel as loose rock.



In addition to the quantities of work remaining to be done, as given in this report, there are,—after allowing for excavation for  $4\frac{1}{2}$  millions of brick, as provided for in the contract,—about 5,000 cubic yards of loose and solid rock, within the lines of the tunnel, which were not included in the original schedule of quantities upon which the contract was based.

*Brick Arch at West End.*

On the 1st of January, 1870, the brick arch had been extended by the contractors 221 feet, and during the months of January and February  $75\frac{1}{2}$  feet additional had been completed, when, on March 30th, the roof of the tunnel broke in from want of sufficient timber support, carrying with it about 24 feet of the brick arch already completed.

Much care was necessary to work through this loose material, 230 feet beneath the surface, and it required three months to repair damages and complete the next sixteen feet. Since that date the work has progressed favorably. On November 1st a second force was put at work constructing arch from well No. 4, which, if continued until the forces unite, will insure the completion of the brick work at the west end in about two and a half years.

*Table showing the Monthly Progress of Brick Arch.*

DATE.	Distance from Portal.	Progress in Linear Feet.	Number of Brick laid.
1870—January 1, . . .	1,152	—	—
February 1, . . .	1,185	33	103,349
March 1, . . .	1,227 $\frac{1}{2}$	42 $\frac{1}{2}$	73,513
April 1, . . .	—	—	—
May 1, . . .	—	—	33,517
June 1, . . .	—	—	57,155
July 1, . . .	1,243 $\frac{1}{2}$	16	75,740
August 1, . . .	1,250 $\frac{1}{4}$	6 $\frac{3}{4}$	32,322
September 1, . . .	1,270 $\frac{3}{4}$	20 $\frac{1}{2}$	64,201
October 1, . . .	1,289	18 $\frac{1}{4}$	57,155
November 1, . . .	1,313	24	75,163
December 1, . . .	1,336	23	72,031
1871—January 1, . . .	1,357	21	65,767
1870—November 1, . . .	1,523	Commenced.	—
December 1, . . .	1,567 $\frac{1}{2}$		98,317
1871—January 1, . . .	1,597	29 $\frac{1}{2}$	40,650
		279	848,880
Work remaining to be done, . . .		773	2,959,905

The estimates of the value of work done by the Messrs. Shanly, computed at the schedule prices, are as follows:—

Amount of estimates for 1869, . . . . .	\$492,388 77
1870—February 1, . . . . .	\$68,323 84
March 1, . . . . .	58,530 01
April 1, . . . . .	71,055 90
May 1, . . . . .	69,817 97
June 1, . . . . .	61,467 91
July 1, . . . . .	73,567 03
August 1, . . . . .	74,759 23
September 1, . . . . .	72,085 06
October 1, . . . . .	63,853 41
November 1, . . . . .	61,851 09
December 1, . . . . .	72,983 91
1871—January 1, . . . . .	59,036 17
	<hr/>
	807,331 53
	<hr/>
Total, . . . . .	\$1,299,720 30

The estimates average for the past year, \$67,277.63, monthly. To complete the work at the contract time, they must average from January 1st, 1871, \$86,477.47, monthly.

The distance between the portals of the tunnel is 25,031 feet. The length penetrated from the east end is 8,036 feet. From the central shaft 147 feet, and from the west end 5,710 feet, making the length opened 13,893 feet, which leaves 11,138 untouched, of which 4,741 feet is between the east end heading and central shaft, and 6,397 feet between the central shaft and west end heading.

Stated in miles, the length of tunnel now opened is 2.631 miles. And the distance remaining, . . . . . 2.110 “

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Making the whole length of tunnel between portals, 4.741 miles.

From the delay in commencing work at the central shaft, it seems probable that the meeting points originally assumed of the several sections will be varied, and that it will be necessary to remove more of the heading and enlargement from the ends

than was contemplated at the time of making the contract. This renders it important that the work from the ends, as well as in both directions from the central shaft, should be vigorously prosecuted.

The following table exhibits the length of headings actually excavated by the Messrs. Shanly, from their commencement of the work ; also the length required to be excavated by the terms of the contract. In this table, the work done previous to July 1st, 1869 (this being the date the contractors were notified to make the progress specified in the contract) is carried out the same in both columns :—

SECTIONS.	LENGTH OF HEADINGS.	
	Actually Excavated.	Required by Contract.
	Lin. Feet.	Lin. Feet.
East End Section, to July 1st, 1869, . . . . .	402	402
“ “ from July 1st, 1869, to Jan. 1st, 1871, . . . . .	2,351	2,250
Central Section, . . . . .	147	1,120
West End Section, . . . . .	1,652	1,800
Totals, . . . . .	4,552	5,572

Less than required by contract, 1,020 feet, or about eighteen per cent.

But the progress of the headings, at the west end, and from the central shaft working westerly,—which are the governing sections,—afford the truest criterion of the prospects of completion, and the following statement exhibits the result :—

	Actual Progress.	Progress required by the Contract.
West End Heading, from July 1st, 1869, to Jan. 1st, 1871, . . . . .	1,652 feet.	1,800 feet.
Central Section, heading west, . . . . .	87 “	560 “
	1,739 feet.	2,360 feet.

Actual progress less than contract requirement, 621 feet, or about twenty-six per cent.

To make up this falling behind, the advance from the west end heading must average about 105 feet per month, and from the central shaft, westerly, 95 feet, or together, 200 feet of completed tunnel, which, unless there is much hindrance from water, or from disrupted rock at the anticlinal axis requiring arching, may still be accomplished.

Very respectfully,  
Your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

HARTFORD, January 25, 1871.



## SENATE....No. 330.

[Supplement to Senate, No. 283.]

## Commonwealth of Massachusetts.

NORTH ADAMS, October 12, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of September was as follows:—

East end heading advanced,	.	.	.	.	.	126 feet
West end heading advanced,	.	.	.	.	.	103 “

The estimate for the month amounts to \$63,853.41. Of this, \$2,900 is for work done at the west end in June, July and August, 1869, and July and August, 1870, the said work being outside of the rock tunnel lines for a length of 285 feet, which it is now assumed will require arching.

At the east end the steam-compressors were in use for seventeen days during the month.

No progress was made on the central section, the contractors being still occupied in trimming the shaft and completing the timber work. At present they do not expect to begin the headings before the 20th instant. The constructing engineer informs me that he has no information that pneumatic drills, or carriages for the same, have yet been contracted for, to be used on this section.

The aggregate advance of headings during the month was 229 feet,—equal to about 63 per cent. of the contract requirements, and although a commencement may be made the latter part of the present month in working east and west from the central shaft by hand labor, there will continue to be a falling behind until pneumatic drills are used.

The necessary levels to find the proper depth of the shaft to grade, have not as yet been completed. Those from the west end vary  $5\frac{1}{4}$  inches from former levels, and ought to be taken over again to determine which is right, but meanwhile the contractors will have to go to work.

In my report of June 14th last, I referred to the unsatisfactory condition of the engineering of the line, and regret to say that but little progress has been since made in re-running and correcting it.

At that time I offered to test the line at the east end, whenever notified that it had been re-run to the heading or where the contractors were at work, which should have been done at once, but on inquiry yesterday I find that it has only been run for about one-third of the distance, where no work has been done during the present year. The dilatory and inefficient manner in which the engineering is attended to can only result in large additional expenditures.

Councillor Adams, in his letter dated September 20th 1870, giving notice that Mr. Frost had been requested to have the estimates of the work completed in time so as to be furnished to the governor and council on or before the 12th of each month, remarks that, "I suppose some slight change in time of your taking the measurement with Mr. Frost may be necessary."

To prevent misapprehension it may be proper to state that neither Mr. Frost or myself take the measurements; they are mainly taken by his assistants during the month and the quantities made up under his direction. My approval of the estimates, therefore, is not based on personal knowledge that the measurements are correct. Having proved many of the estimates to be erroneous I deem it right that this should be understood.

My object in seeking a detailed statement of the work to be done under the Shanly contract (Mr. Frost having destroyed

the original calculations on which the contract was based), was to have some check on the monthly estimates, and, since I have received a partial statement it has been found very effective for this purpose. ✓

Very respectfully, your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

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BOSTON, November 14, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of October was as follows:—

East end heading, advanced, . . . . .	127 feet
Central shaft, east heading, advanced, . . . . .	3½ “
Central shaft, west heading, advanced, . . . . .	9½ “
West end heading, advanced, . . . . .	125 “

The estimate for the month amounts to \$61,851.09.

Nothing of special moment has occurred at the east end workings.

At the west end heading the rock is reported to have been of a more favorable character, and better progress has been made than during any previous month.

From the bottom of the central shaft, excavation for tunnel, both east and west, was commenced October 25th, with a small force,—work having been delayed a few days in consequence of an accident which occurred from a new wire rope not having been made properly fast to the hoisting drum, and by which the superintendent of the work at the shaft, the master mechanic and a mining foreman lost their lives.

Nearly two and a half months have been occupied in enlarging and trimming shaft, putting down new guides and shifting floor-beams which had been allowed to be placed in position of the range lines. Of this time probably about one month was

occupied on the Shanly work, and mainly due to their having been allowed to make the shaft of less than the contrast size while paying them full price for the same, as referred to at meeting of council, April 6th, and in my report of April 25th. The result will be delay in completing the work, with interest on expenditures accumulating at the rate of \$40,000 per month.

The levels from the east portal to the central shaft were completed during the past month, but they do not agree within nine and a half inches of those taken from the west end. The excavations, however, as already mentioned, have been commenced from the bottom of the shaft, without, of course, knowing whether at the proper grade or not.

On October 24th, Mr. Frost stated that he would commence the levels the following day, and have them re-run over the mountain in three weeks from that date, or by November 15th, but they have only been commenced within a few days and will not be completed for some time.

Yesterday I examined a portion of the line recently re-run at the east end, and found that in the heading of the last twelve months' working, the range of the line varied from three-fourths of an inch to two inches, averaging about one and a half inches from the markings originally made. And as the range of the new line is, without exception, uniformly to the north of the old markings, this seems to me a sure indication of a change of line to this extent. Mr. Frost, however, was not present, and had previously stated a much less variation. To correct a variation of a single inch in the line will cost the contractors about \$20,000 per mile for full-size tunnel,—an expenditure solely due to imperfect engineering.

Whether the line is now entirely correct I think is somewhat questionable, having been run before testing the surface line on which one of the range poles has since been found to be out of position.

At the east end, during the months of September and October, portions of the bottom of the heading were not excavated down to the grade by from 2 to 15 inches. To remove this will be quite costly, and I know that if the Messrs. Shanly were duly notified whenever the work is being prosecuted above grade they would not allow it to be continued. The mere giving of



levels (generally some distance behind the actual headings), and pointing them out to the foreman of the gang, if he happens to be present, is not sufficient, as the foremen, legally, do not represent the contractors.

I recommend that the consulting engineer be directed to notify the contractors officially, whenever the work is being prosecuted above grade.

On the headings already made by the Shanlys at the east and west ends, I estimate that they will have to expend from \$6,000 to \$8,000 more than would have been necessary if the bottoms had been taken down to grade in the first instance.

Very respectfully, your most obedient servant,

JAMES LAURIE, *Consulting Engineer.*

NORTH ADAMS, December 14, 1870.

His Excellency WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of November, was as follows:—

East end heading advanced,	. . . . .	133 feet.
Central shaft, east heading, advanced,	. . . . .	30½ “
Central shaft, west heading, advanced,	. . . . .	45½ “
West end heading,	. . . . .	130 “

The estimate for the month amounts to \$72,983.91.

At both the east and west end headings good progress has been made. At the latter the rock continues to improve and is of a more uniform character than heretofore. Additional steam power has also been brought into use at this end, which in part accounts for the greater progress made.

From the central shaft the work is being prosecuted by hand labor, and will continue to be so until the headings get about 300 feet apart. The actual advance during the month, it will be observed, was only 30½ feet east, and 45½ feet west.

The headings, both east and west, are being made at the roof of the tunnel, and must necessarily follow the descending grade. I would have preferred to see them in the bottom. In making them at the top, the water met with will accumulate at the lower or advance end of the headings, and have to be pumped out through a long line of hose or pipe, and if it should afterwards, from the increase of water, be found necessary to change the bottom, much valuable time will be lost. Otherwise a heading at the top is undoubtedly the cheapest.

Some of the small gearing of the hoisting machinery at the central shaft got broken on December 8th, and work had to be suspended. It is expected that the necessary repairs will be completed and the work resumed by the 16th instant.

The second line of levels over the mountain has been completed, and is reported to agree substantially with the first.

Several levelling staffs, however, having been used, *corrections* have been made for their varying lengths. On the first line  $10\frac{1}{2}$  inches were added to the elevations on the east side of the mountain, and  $3\frac{9}{10}$  inches deducted from those on the west side. These corrections bring the first line of levels to within 5 inches of those taken under Mr. Doane's direction.

On the second line it appears that five different staffs were used, on four of which corrections were made.

This plan of making corrections is a very unreliable and unsatisfactory method of getting the true level, and I have recommended Mr. Frost, as I did originally, to continue one line across the mountain, using the same levelling staff throughout. This will render it necessary to re-level from the central shaft to one of the ends.

The portions of the tunnel already constructed were laid out by some of these same staffs without any corrections, but from the small rise on the line of the rails, the difference would not be important, and I do not think that the contractors or the State ought to be subjected to any additional expense by modifying the work already done.

The depth of the central shaft was determined by a steel tape without making any comparison with a standard, so that altogether the levels have got to be in a very mixed up and chaotic condition.

Since the commencement of the work by the Messrs. Shanly, the rock in the bottom of the brick tunnel has not been excavated down to grade. For the last three months it averages about fifteen inches above the proper level, and as most of it is quite hard and will require to be blasted, there is danger that the foundations or the brickwork may be injured. There is the further disadvantage that the water is backed up through the driftway, so that where the second brick gang are at work the foundations are under water, the rock there also being above grade.

I recommend that instructions be given to have the rock taken down to grade, and that in future no brickwork be laid by the first gang until the bottom of each section is taken down to the proper level. A small ditch of 120 feet in length will then drain the second gang.

The Messrs. Shanly, I learn from Mr. Frost, have never been informed that the bottom of the brick tunnel is above grade, the allowance made by him of full price for this work up until May last being for the special benefit of the sub-contractor.

I annex a copy of correspondence (which explains itself) in reference to the bottom at the east end workings being above grade, and which has been communicated to Mr. Frost.

Very respectfully, your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*

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(Copy.)

NORTH ADAMS, November 11, 1870.

BENJ. D. FROST, Esq., &c.

DEAR SIR:—Did you notify the *Messrs. Shanly* in September that portions of the bottom of the East End heading was considerably above grade, and did you do so in October?

JAMES LAURIE, C. E.

(Copy.)

NORTH ADAMS, November 11, 1870.

JAMES LAURIE, Esq., &amp;c.

DEAR SIR:—In reply to your note, notice is given each week to the Messrs. Shanlys' superintendent or deputy in charge upon each section of the work as to their excavation and headings, whether the bottom is found below, or at, or above proper grade; and if above proper grade, amount of error is stated.

The above has been my usual form of notice, and I do not recall having given any exceptional notification on this point during months of September and October.

Yours, &amp;c.,

BENJ. D. FROST.

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[Copy.]

NORTH ADAMS, November 12, 1870.

Messrs. W. &amp; F. SHANLY, &amp;c.

GENTLEMEN:—Are you aware that since about the 1st of September portions of the bottom of the east end heading are from two to fifteen inches above grade.

Yours, &amp;c.,

JAMES LAURIE, C. E.

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[Copy.]

NORTH ADAMS, 12th November, 1870.

DEAR SIR:—We are in receipt of your letter of this day's date informing us that since 1st September, the bottom of east end heading has been taken out *above grade*. We were *not* previously aware of the fact, having had no intimation on the subject from Mr. Frost.

In respect to both lines and grades, so long as the engineers on the work do not tell us we are wrong, we, of course, assume



that we are right, and shall certainly look to the State to indemnify us for the expense of going over our work a second time to rectify errors for which we are not responsible.

It sounds somewhat strange to our ears that notification of errors in grade should come to us through the consulting engineer, an occasional visitor of the works only; as in this instance, and on February 19th last, while the resident engineers would apparently allow errors to go on forever, exactly as if if they wished us to be wrong.

Yours, &c.,

F. SHANLY & CO.

JAMES LAURIE, *Consulting Engineer.*

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[Copy.]

HARTFORD, November 21, 1870.

MESSRS. W. & F. SHANLY, &c.

GENTS:—Your favor of the 12th instant, postmarked N. Adams, 14th, and directed to Hartford, has been received.

My connection with the Hoosac Tunnel, as you infer, being simply that of consulting engineer, I have no responsibility for giving either the line or levels on the work, and I supposed that you would understand my note of the 12th instant to be extra official.

The case appears to stand thus: In September and October I found the bottom of the east end heading considerably above grade and on inquiry of Mr. Frost was informed that he had given weekly notice of its condition. On November 11th, he wrote to me as follows: "Notice is given every week to the Messrs. Shanlys' superintendent or deputy in charge, upon each section of the work, as to their excavation and headings, and whether the bottom is found below, or at, or above proper grade, and if above proper grade, amount of error is stated."

You on the other hand, say in your letter of the 12th, that (you) "We are *not* previously aware of the fact, having had no intimation from Mr. Frost." What are the real facts I do not presume to determine, but seeing a great and unnecessary

waste of labor and money, I thought it advisable (although not in the line of my official duty), to notify you. In this view of the case while I make no objection to the information conveyed in your letter, I think there is some impropriety in your notification that you will look to the State to indemnify you for the expense of going over the work a second time. Any notice of this kind, I think, ought to be addressed to Mr. Frost or to the governor and council.

Yours, &c.,

JAMES LAURIE, *Consulting Engineer.*

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NORTH ADAMS, January 13, 1871.

HIS EXCELLENCY WILLIAM CLAFLIN, *Governor of Massachusetts.*

DEAR SIR:—The progress made at the Hoosac Tunnel during the month of December, was as follows:—

East end heading, advanced,	.	.	.	.	115 feet.
Central shaft, east heading, advanced,	.	.	.	.	10 "
Central shaft, west heading, advanced,	.	.	.	.	16 "
West end heading, advanced,	.	.	.	.	130 "

The estimate for the month amounts to \$59,036.17.

Work at the east end was interrupted for about one week during the month, from several causes—Christmas, destruction by fire of the principal boarding-house for the men, and loss of life thereby, funerals, &c.

At the west end heading good progress was made. The rock continues of a favorable character, although still much harder than that at the east end.

At the central shaft some of the small gearing of the hoisting machinery failed on December 8th, compelling a suspension of work. It was expected to have resumed operations on December 16th, but it was then discovered that other important parts of the machinery had got injured, and that a new shaft

was necessary. To procure this and make the necessary repairs delayed the resumption of the work until January 3d. Small progress, therefore, was made on this section during the month.

The magazine attached to Professor Maubray's nitro-glycerine works exploded on December 23d, but no destruction was caused thereby, although the superintendent was killed, the manufacturing of the article being continued the following day in sufficient quantity to supply the contractors.

Mr. Doane's surface line over the mountain has been tested by Mr. Philbrick, and in every instance his station marks were found to be correct.

Mr. Philbrick has also re-run the underground line at the east end, which was found to correspond nearly with Mr. Frost's *last* line; the variation within 1,000 feet of the heading being about one-fourth of an inch to the south, which is an addition to the more important variation from the correct line as originally given, referred to in my report of November 14th.

The underground line at the west end has not as yet been re-run, and it is very desirable that it should be, for although lines can be run more readily after a tunnel or drifting is enlarged, what the contractors want and the Commonwealth have agreed to give, are correct lines and levels as the work progresses. Still, I have no special reason to suspect any inaccuracy in this line.

No further attempt has been made to get reliable levels over the mountain, the importance of which I made reference to in my reports of June, August, September, November and December last. It is now proposed to wait until next spring or summer, when they can be taken more correctly and comfortably, which will render a change of grade necessary in the tunnel if the present levels are incorrect, and in all probability extra work to be paid for by the State. Doane's levels, also my own in 1862, were taken in the winter, and so far there has been very little snow here or on the mountain that would interfere.

Very respectfully,

Your most obedient servant,

JAMES LAURIE,  
*Consulting Engineer.*





No 15.

SENATE.....

.....No. 6.

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# REPORT

OF

## BENJ. H. LATROBE,

*CONSULTING ENGINEER,*

ON THE

### TROY AND GREENFIELD RAILROAD AND HOOSAC TUNNEL.

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BOSTON:

WRIGHT & POTTER, STATE PRINTERS,  
79 MILK STREET, (CORNER OF FEDERAL.)

1869.



## Commonwealth of Massachusetts.

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BALTIMORE, December 18, 1868.

His Excellency ALEXANDER H. BULLOCK, *Governor of Massachusetts.*

SIR:—In the two previous Annual Reports upon the Troy and Greenfield Railroad and Hoosac Tunnel which I presented to yourself and the honorable executive council, it appeared proper that, although the details of the work were furnished by the reports of the commissioners and their engineers, I should embrace them in my own report so far as was necessary to enable me to express more fully the views which I entertained as your consulting engineer upon the most judicious mode of conducting it.

The new position which the work has assumed under the Act of the last session of the legislature of the State, and the consequent approaching termination of my official relations to it, renders it unnecessary that I should enter again into similar particulars, and I therefore respectfully submit the ensuing brief notice of what has occurred in connection with it since my last report and the results in its present and prospective condition.

### TROY AND GREENFIELD RAILROAD.

The railway was opened to the public upon the 15th of August last, from Shelburne Falls, the point it had reached at the date of my last annual report (December 20th, 1867,) to within about a mile of the eastern portal of the tunnel, and passengers began at that date to be conveyed across the mountain to North Adams in coaches from Jenks' Hotel, on the opposite

side of the Deerfield River. Since that time a convenient station and engine-house have been there erected with sufficient siding track for the business of the temporary terminus at that point; and a lattice truss bridge for common travel has been thrown across the river for communication at all times and states of the river. The track has been well laid between Shelburne Falls and this point, and besides the usual deficiencies in width of road-bed, especially on embankments, no complaint can be made that the contractor, Mr. Farren, has not completed his work satisfactorily.

The bridge by which the railway is to cross the Deerfield River near the tunnel is now in progress, and when completed the spoil from the tunnel will be carried over it and the embankment made therefrom, on which the track may be extended from its present end to the tunnel for facility of delivering and receiving material thereat.

On the *west* side of the mountain, between the tunnel and the depot of the Troy and Boston Railroad, in the village of North Adams, the two miles of road is not yet located. I have called attention to this subject in several previous reports, in the last of which I recommended that it should be definitely staked out upon or near a line traced upon a map submitted with the report. This I understand will now be shortly done.

#### THE HOOSAC TUNNEL.

The work at the *east end* and *central shaft*, contracted for with Messrs. Dull, Gowan, and White, reverted to the State in November of last year, by the release of the contractors from its farther prosecution, and has since been conducted by the commissioners and their superintending engineer with results which will be reported in detail by those officers. The advance of the heading and enlargement at the *east end* which took place under the contract, was stated in the last annual report. The progress of the *heading*, after the retirement of the contractors, was 802 feet during seven and one-half months actual working, or 107 feet per month; the rate being much reduced by anchor-ice in the canal during the winter, and low water in the summer. Some of the lost time was occupied in repairs of the compressors; but work was afterward prosecuted in part only, and finally suspended, owing to the limited means at dis-



posal of the commission. The enlargement was prosecuted at the same time, and at the time of suspension of the entire work at this end of the tunnel in September last, eight hundred feet had been entirely completed; and within the distance of about half a mile from the portal there required the removal of less than five thousand yards to complete the excavation to its full dimensions of twenty-four feet in width by twenty feet in height. The work at the wheel-house of completing the flume, putting in the two new compressors, repairing one of those in previous use, and arranging the machinery for the application of assistant steam power when required, was in progress during the past summer and autumn, and is now finished. These additions and improvements will, it is believed, furnish sufficient power for drilling and ventilation to the end of this section of the work, when a steam-engine of suitable capacity shall have been provided for periods of obstruction by ice and short supply of water.

At the *central shaft*, the work done since the last annual report has consisted of what was required to replace the buildings and machinery destroyed by the fire of October, 1867, which, after much delay, was accomplished within the last few weeks. The new machinery is very superior in capacity and arrangement to that which preceded it, and when the sinking of the shaft shall be resumed, more rapid progress should be made than heretofore under similar circumstances as to character of rock, amount of water, &c.

The *west shaft*, in its workings east and west, went forward until at the time of stopping work at the *east end* in September last, the *east* heading was suspended, and the draining drift or adit towards the west end alone continued until, on the 27th of October, a junction was effected with the adit driven eastward from the west end, and the water being provided with a channel which permitted it to pass off by the natural flow, the pumping was discontinued. The discharge through the several pumps appears at that time to have been a little over 500 gallons per minute, a large decrease upon what was reported to have been raised a year ago from the same workings, and showing that as the tunnel progresses an increase of water need not be expected as a matter of course, but that the contrary may in fact be realized. The work of drifting and arching the

tunnel of its full size under Mr. Farren's contract has advanced regularly during the year, and the 931 feet from the west portal to which his contract extends will be completed in another month or two. The character of the excavation has improved so much and the floor of the tunnel has become so sound as to permit the discontinuance of the brick inverted arch during the last two months' work, and there will probably be no further occasion for its use. The thickness of the arch and side walls, has also been recently somewhat lessened and may with safety be still further diminished.

The water from the tunnel, in its now increased volume, still finds its way out through the "Haupt tunnel" west of the portal, and must continue to do so until the approach cut is opened, which it is understood will engage the early attention of those in charge of the work.

The preceding remarks seem to embrace all that is necessary for me to say in regard to the progress and condition of the tunnel and its connected works to this time.

The policy of the contract system for the further prosecution of it to completion, which my previous reports will show me to have recommended, having been adopted by the legislature in their Act of June 11, 1868, and the work having been contracted for with parties whose testimonials of character afford every reasonable assurance that they will perform what they have undertaken, and whose financial ability will be thoroughly tested by the reservation of the large amount which they have agreed to leave in the hands of the Commonwealth as a guarantee, I think the difficulties which have attended this great enterprise may be considered practically at an end. Vast as is the magnitude of the work, it has not in fact presented physical obstacles as formidable as those which have embarrassed many other undertakings of similar work. The "demoralized rock," as it has been called, at the west end, was indeed a troublesome feature, but not as bad as the quicksands and slippery clays of some of the English tunnels. The water in the west shaft required only good pumps and ample power to keep it down. The central shaft has been dry and attended with no drawbacks except that which casualties, that might have been avoided with ordinary care, have produced, and lastly the east end has been as straightforward and really *comfortable* a piece of under-

ground work as could be wished for. The real difficulties of the enterprise have been due chiefly to other causes of an extraneous character, to which, as it is hoped that they are now no longer in action, it is not necessary to refer more particularly.

The services of a consulting engineer under this essential change of circumstances being no longer indispensable and especially with so able, experienced and faithful a superintending engineer residing on the work, I have felt it to be proper, even before receiving an intimation to that effect, to tender my resignation to take effect at the end of the present month, and in doing this I beg leave to offer to yourself and the honorable council my grateful acknowledgments for the uniform and friendly courtesy which I have received at your hands.

I have the honor to be, most respectfully, yours,

BENJ. H. LATROBE,  
*Consulting Engineer.*

BALTIMORE, December 20, 1868.

His Excellency ALEXANDER H. BULLOCK, *Boston*.

DEAR SIR:—Just as I was about mailing my annual report and the note accompanying it, both of which are inclosed, I received your letter of the 18th, inquiring of me “whether, in my judgment as an engineer, it will cost appreciably more to remove the stone from the workings farthest from the east and west ends of the tunnel than it will to remove it from the headings nearest to those points respectively.”

I feel no hesitation in making a *negative* reply to the inquiry. The universal experience of all works of this kind is, that they cost more per cubic yard or any other unit of measure *first* than *last*; that is, if no new, and in this case very unlikely, feature of difficulty develops itself during its progress. The expense of *transporting* the rock removed, (which is much the smallest part of the whole expense,) will undoubtedly increase as the *distance* to which it has to be carried increases, but not in as rapid a ratio, as the cost of loading and unloading the material is the same for all distances alike. On the other hand, however, there being assumed, as there must be in this case, an ample supply of power for drilling and ventilation, the cost of excavation will diminish in rock of equal average hardness, as the force of men employed in that operation acquires increasing skill in all the necessary manipulations. The drilling machines themselves will also undergo steady improvement and work more efficiently and economically, as past experience of the Hoosac Tunnel clearly shows. The present machines are susceptible of marked improvement, and have been greatly improved, as I learn, by their inventor, Mr. Burleigh, who has perfected a new machine with but half the number of parts subject to breakage, and this machine, or some other equally good, will no doubt be used by the contractors as fast as they can replace the present one by the improved one. There is



one cause which must manifestly tend to equalize the cost of present and future work, and that is the *immediate* outlay which the contractors must make in starting their work, and which must be charged upon the cubic yards they remove, the charge per cubic yard lessening, of course, as the number of yards increases.

Referring again to the experience acquired at the Hoosac Tunnel, I would suggest a comparison between the cost per cubic yard of the material removed during the successive years of its conduct by the Commonwealth, which will be found in a diminishing ratio until, as a detailed statement prepared by the present superintending engineer shows, it declined from upwards of \$20 to a little over \$9 in the east end headings.

The experience at Mont Cenis is still more to the point. An examination of the tabular statement appended to my last Annual Report, showing the successive advances of that work from year to year, exhibits very strikingly the increased economy resulting from increasing skill in working. The *force* that can be employed in tunnelling is absolutely *fixed* by the limited space in which it can work, and the rate of progress is therefore a fair index of the relative expense. With some irregularities from special causes, it will be seen that the progress since machine labor began has increased greatly, compared with the first three years of inexperienced working, although the penetration into the mountain had more than doubled at the commencement of this year.

Respectfully and truly yours,

BENJ. H. LATROBE,  
*Consulting Engineer.*

STATEMENT OF COMMISSIONERS ON TROY AND GREENFIELD RAILROAD AND HOOSAC TUNNEL.

*Amount of Money appropriated for the Construction of the Troy and Greenfield Railroad and Hoosac Tunnel.*

The first appropriation of \$2,000,000 was authorized by the 226th chapter of the Acts of 1854, . . .	\$2,000,000 00
In 1860, chapter 202, an issue of scrip, amounting to \$200,000, was authorized, to enable the Troy and Greenfield Railroad Corporation to purchase the Southern Vermont Railroad, building from the State line of Massachusetts to that of New York,	200,000 00
In 1865, chapter 221, there was appropriated, . . .	800,000 00
In 1865, chapter 293, . . . . .	900,000 00
And in 1867, . . . . .	600,000 00
The last three sums for the construction of the railroad and tunnel.	
In 1868, by chapter 249, was appropriated for the completion of the railroad, . . . . .	250,000 00
And by chapter 350, of the same year, \$250,000 was authorized to be expended upon the tunnel, . . .	250,000 00
<hr/>	
Making in all the sum of (whole amount,) \$5,000,000 appropriated by the State for the tunnel, the Troy and Greenfield and Southern Vermont Railroads, . . . . .	\$5,000,000 00
Undrawn from tunnel appropriation, 1868, . . . . .	
In the hands of cashier, . . . . .	\$32,109 78
Undrawn from Troy and Greenfield Railroad appropriation, 1868, . . . . .	14,744 29
In the hands of cashier, . . . . .	34,147 08
	177 69
	<hr/>
	81,178 84
	<hr/>
	\$4,918,821 16

Amount expended on railroad from		
Greenfield to Tunnel Station, .	\$1,300,922	29
Amount paid for Southern Vermont		
Railroad, . . . . .	200,000	00
	<hr/>	\$1,500,942 29
		<hr/>
		\$3,407,878 87
Deduct interest charged to appropriations from		
1861 to 1867 inclusive, . . . . .		473,767 94
		<hr/>
Amount expended on the tunnel, . . . . .	\$2,934,110	93
Liabilities on tunnel amount, viz.:—		
Due B. N. Farren, for work, to		
Dec. 31, . . . . .	\$39,765	64
To complete his contract, about .	18,000	00
Unpaid bills to Dec. 31, including		
pay-roll, . . . . .	10,300	00
	<hr/>	68,065 64
		<hr/>
Total cost of tunnel to Dec. 31, . . . . .	\$3,002,176	57
Contract with Walter and Francis Shanly to com-		
plete the tunnel, . . . . .	4,592,000	00
	<hr/>	
Total cost of tunnel, . . . . .	\$7,594,176	57
Amount advanced by the State to construct the		
Troy and Greenfield Railroad, under chapter 202		
of the Acts of 1860, to the contractors, Messrs.		
Haupt & Co., . . . . .	\$481,428	00
Advanced by the State to settle Messrs. Haupt &		
Co.'s liabilities for labor, land damages, &c., .	175,000	00
	<hr/>	\$656,428 00
Total expenditures since August, 1861, to complete		
the Troy and Greenfield Railroad from Greenfield		
to Tunnel Station, . . . . .	640,607	16
Repairs under the lease, . . . . .	3,887	13
	<hr/>	
Cost of railroad from Greenfield to Tunnel Station,	\$1,300,922	29

To extend the railroad to east end of tunnel, . . .	\$55,328 00
To complete the railroad from west end of tunnel to North Adams, exclusive of depot buildings, 2 paths, at \$55,000 per mile, . . . . .	110,000 00

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Cost of Troy and Greenfield Railroad to No. Adams,	\$1,466,250 29
Paid for the Southern Vermont Railroad, . . .	200,000 00

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Cost of the railroad from Greenfield to the line of the State of New York, exclusive of the tunnel, .	\$1,666,250 29
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## SUMMARY.

Total cost of tunnel, including work, . . .	\$7,594,176 57
Total cost of railroad, . . . . .	1,666,250 29
Total cost of tunnel and railroads 50 miles in length,	\$9,260,426 86



*Aggregate Amounts of the several bids for the completion of the  
Hoosac Tunnel.*

1. Carpenter, Odiorne & Gardner, . . . . .	\$4,027,780 00
2. Uran, Brother & Co., . . . . .	4,437,886 00
3. Francis and Walter Shanly, . . . . .	4,623,069 00
4. Jacob Humbird & Son, . . . . .	4,690,183 00
5. Clark, Lyon, Hayden, Byron & Malone, . . . . .	4,690,650 00
6. Bradbury & Duff, . . . . .	4,800,000 00
7. Stanton & Doane, . . . . .	4,881,766 00
8. H. Haupt, . . . . .	5,000,000 00
9. Thomas Rutter, . . . . .	5,302,000 00
10. L. Hitchcock & Co., . . . . .	5,342,357 00
11. A. G. Brown, C. W. Wentz & I. Brooks, . . . . .	5,371,142 00
12. S. C. Walker & Co., . . . . .	5,378,354 00

The above parties have bid for the entire work.

The following have bid for it only in part :—

13. I. I. Dull, east end, . . . . .	\$1,195,800 00
Do. west shaft, . . . . .	1,656,127 00
14. McMahon & Kelly, east end, . . . . .	1,261,000 00
15. B. N. Farren, west shaft in part.	

## MEMORANDUM OF AN AGREEMENT

*Made at Boston on the twenty-fourth day of December, A. D. 1868, between WALTER SHANLY, of Montreal, and FRANCIS SHANLY, of Toronto, Canada, parties of the first part, and the COMMONWEALTH OF MASSACHUSETTS, party of the second part.*

The parties of the first part hereby covenant and agree with the said Commonwealth to do and perform all the work necessary to complete the Hoosac Tunnel, with its Central Shaft, (being a portion of the Troy and Greenfield Railroad,) in accordance with the schedule hereunto appended, and furnish all materials, and lay down and complete through the whole length of the tunnel one railroad track, and after the completion of the tunnel and railroad track to remove from the tunnel all materials and other things, so as to leave the tunnel and railroad track in complete order, ready for use, and to the satisfaction of the Governor and Council of the Commonwealth; the whole to be done by the 1st day of March, A. D. 1874, and for the sum of four million five hundred and ninety-four thousand two hundred and sixty-eight dollars, (\$4,594,268,) to be paid, together with any interest accruing under this contract, by the Commonwealth to the parties of the first part, their heirs, executors, administrators or assigns, in United States Treasury notes, or other current funds, as hereinafter provided.

The size and general description of the work; the estimated amount of the same; the regulations governing the manner of its performance; the rates of progress required in its prosecution; and various general and particular stipulations and provisions affecting and binding both parties hereto, are set forth in the schedule hereunto appended, which constitutes a part of this agreement. But no errors in the estimates of the work to be done and materials to be furnished under this contract, shall affect the contract price to be paid for the whole work.

The parties of the first part will provide suitable and sufficient materials and machinery, and a sufficient and competent working force, and enter upon the prosecution of the work as soon as possible after the execution of this agreement, and will keep on hand and in operation at all times every means necessary to an expeditious and thorough fulfilment of this agreement on their part, according to its true intent and meaning.

And whereas, in consequence of the stopping of the work at the several points of operation, and for other reasons, the parties of the first part may not be able at the commencement to make the rate of progress prescribed in the schedule hereunto appended, it is agreed that the governor and council may fix the time from and after which such rate of progress shall be made, and give notice thereof to the parties of the first part; which time, however, shall not be earlier than the 1st day of May next.

And whereas that portion of the tunnel which lies between the west and central shafts is expected to require a longer time for its construction than the other portions thereof, and difficulties now unexpected may arise, making it impossible to preserve the said prescribed rate of progress in other portions of the tunnel, it is agreed that in case of necessity the governor and council may by formal vote determine what extension of time shall be allowed; provided, however, that in no case shall the final completion of the whole work be delayed more than six months after the 1st day of March, A. D. 1874.

And if, after a full and fair opportunity has been had by the parties of the first part, the rates of progress prescribed by the schedule hereunto appended have not been made, and it shall plainly appear to the governor and council that the parties of the first part are and will be unable to make such rates of progress, on the average, the governor and council, after giving to the parties of the first part three months' notice in writing of their intention to do so, may, if their default continues, put an end to this contract, and resume possession of the work, and of all the shops, dwelling-houses, buildings, machinery, tools, and all the property whatsoever, belonging to the Commonwealth, which may have been delivered to the parties of the first part for use under this agreement.

The engineer or engineers of the Commonwealth shall give the lines and grades of the tunnel, and the lines of the central shaft, and be responsible therefor.

And for the purpose of determining the amount earned by the parties of the first part, from time to time, as the work proceeds, and for no other purpose, the following list of prices shall be taken as a basis of computation.

#### EAST END SECTION.

1st. For tunnel enlargement, per cubic yard, *sixteen dollars.*

2d. For heading enlargement, per cubic yard, *nine dollars.*

3d. For extension of full sized tunnel, per cubic yard, *eleven dollars.*

4th. For excavation and construction of central drain, with air and water pipes complete, per linear foot of tunnel, *thirteen dollars.*

5th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

#### CENTRAL SECTION.

1st. For constructing fire-proof floor over the shaft with self-closing iron hatches, *two thousand dollars.*

2d. For repair and completion of timbering to present depth of shaft, per foot in depth, *ten dollars.*

3d. For sinking shaft, per foot in depth, *three hundred and ninety-five dollars.*

4th. For two ten-inch iron pipes, set in place, per foot in depth of shaft, *six dollars.*

5th. For sinking sump below floor of tunnel, per foot in depth, *three hundred and ninety-five dollars.*

6th. For excavating full size section of tunnel, per cubic yard, *fourteen dollars.*

7th. For excavation and construction of central drain, with air and water pipes complete, per linear foot of tunnel, *thirteen dollars.*

8th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

#### WEST END SECTION.

1st. For heading enlargement, per cubic yard, *nine  $\frac{75}{100}$  dollars.*



2d. For extending full size tunnel east, per cubic yard, *twelve dollars.*

3d. For arching part of tunnel with bricks, per M of bricks laid, *twenty-two dollars.*

4th. For excavating and constructing central drain and laying pipes for supply of air for power and ventilation and water, per linear foot of tunnel, *thirteen dollars.*

5th. For excavating central drain only, per linear foot of tunnel, *four  $\frac{35}{100}$  dollars.*

6th. For constructing central drain west of west shaft, per linear foot, *three dollars.*

7th. For excavating for and constructing fifty linear feet of stone arch and filling over the same, *twenty-three thousand dollars.*

8th. For excavating for and constructing façade to the tunnel and filling around the same, *twenty-six thousand dollars.*

9th. For clearing out and timbering the Haupt tunnel and maintaining the same, *eight thousand five hundred dollars.*

10th. For furnishing and laying one track complete, per mile, *fourteen thousand dollars.*

And the engineer or engineers of the Commonwealth shall make a monthly measurement and computation of the amount of work done by the parties of the first part, which measurement and computation shall be conclusive upon the parties of the first part; and said engineer or engineers shall each month deliver a certificate in writing, with a statement of the amount in money which has been earned accordingly, to the governor and council.

And whereas it is provided by the statute of 1868, c 333, that this contract shall contain satisfactory guaranties for the completion of the whole work herein contracted for, with limitations as to time and cost therein specified; and it is also provided by the statute of 1868, c 350, that this contract shall provide for payments by instalments, as the work progresses, in such manner that not less than twenty per centum of each amount due shall be reserved for a final payment on the completion of the same: Now, therefore, it is agreed that no sum whatever shall be demanded by or paid to the parties of the first part, under and in pursuance of this contract, until after they shall have earned, according to the certificates of the

engineer or engineers, as above provided, approved by the governor and council, the full sum of five hundred thousand dollars ; but twenty per cent. of each amount so certified by the engineer or engineers shall be reserved for the final payment on the completion of the whole work ; and, for eighty per cent. of each amount so certified, certificates of the Commonwealth, under direction of the governor and council, and in form to be determined by the attorney-general, and approved by the governor and council, shall be issued to the parties of the first part, in sums of twenty thousand dollars each, setting forth the facts, bearing interest at the rate of five per cent. per annum from the time of issuing the same until the time of their redemption, and they shall be paid in Boston from time to time, in the order of their issue, as often as it shall appear by the further certificates of the engineer or engineers, approved by the governor and council, that the parties of the first part have earned so much, that, after reserving twenty per cent. thereof, the Commonwealth will still retain, in all, the full sum of five hundred thousand dollars which is covered by said certificates of the engineer or engineers—it being the intention of the parties hereto that the Commonwealth shall make no payment which will at any time reduce its security from the reserved fund of twenty per cent. and from its guaranty fund aforesaid, below the sum of five hundred thousand dollars. And the Commonwealth shall, until the completion of the contract, reserve twenty per cent. of each amount due for work done, according to the certificates of the engineer or engineers, for a final payment, without any addition for interest, on the completion of the whole work herein contracted for, and its acceptance by the governor and council ; and, subject to the above reservations and provisions, the Commonwealth shall pay to the parties of the first part, at Boston, on or before the fifteenth day of each month following the performance of the work, eighty per cent. of the amount of money earned by them, as ascertained and shown by the certificates of the engineer or engineers ; and upon the final completion of the whole work herein contracted for, and its acceptance by the governor and council, and upon the surrender by the parties of the first part to the Commonwealth of all real and personal property of the Commonwealth which the Commonwealth will then be entitled to receive from

them, under the terms of this contract, and in reasonable and proper condition and manner, (reasonable use and wearing thereof, and loss or damage by fire or other unavoidable casualty excepted,) and upon the adjustment of all questions growing out of this contract, and the execution and delivery by the parties of the first part of a release of all claims and demands upon the Commonwealth growing out of this contract, then the Commonwealth will pay to the parties of the first part such further sum as may be necessary to make up the full amount of four million five hundred and ninety-four thousand two hundred and sixty-eight dollars; provided that no more than \$3,594,268 shall be paid until the final completion of said work.

In witness whereof the said parties of the first part have hereunto set their hands and seals, and the governor of the Commonwealth and the council have also subscribed these presents and caused the seal of the Commonwealth to be hereunto affixed, on the day and year first above mentioned.

[STAMP.]

W. SHANLY, [SEAL.]

F. SHANLY, [SEAL.]

By his attorney, W. SHANLY.

[SEAL.]

ALEXANDER H. BULLOCK,

*Governor.*

WILLIAM CLAFLIN,

*Lt. Governor.*

THOS. TALBOT,  
JOHN S. BRAYTON,  
CHAS. ADAMS, JR.,  
HORATIO G. KNIGHT,  
CHAS. ENDICOTT,  
PETER HARVEY,  
R. G. USHER,  
A. K. P. WELCH,

*Executive Councillors.*

## SCHEDULE.

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### DIMENSIONS OF THE TUNNEL.

In rock, without arch, 24 feet wide in the clear; 20 feet high in the clear.

Where arching is required, 26 feet wide in the clear;  $21\frac{1}{2}$  feet high above the rail when laid down.

A central drain to be constructed as required, with dimensions inside of masonry of not less than 2 feet square.

### THE WORK REQUIRED TO BE DONE AT THE HOOSAC TUNNEL, UPON THE TROY AND GREENFIELD RAILROAD.

#### I.—EAST END OF TUNNEL.

The work already done consists of a tunnel extending into the mountain from the east portal about 2,500 feet, a portion of which has been enlarged to the full height of 20 feet and the width of 24 feet, as proposed, and of a heading about 2,782 feet long, of which 1,700 feet has an average section of about 16 by 8 feet, and the remaining 1,082 feet a section of about 24 by 8 feet, making the distance penetrated from the east portal, 5,282 feet.

#### *The Work to be Done is*

1st. Enlargement of tunnel to full size of tunnel section required. Estimated amount, 4,500 cubic yards.

2d. Enlargement of heading to full size of tunnel section required. Estimated amount, 28,000 cubic yards.

3d. Extension of full size section of tunnel westward to meet workings to be brought eastward from central shaft. Estimated length, 5,300 feet, making 85,100 cubic yards.

4th. Excavation below floor of tunnel, and construction of a central drain, as exhibited on the sectional drawing in engi-



neer's office in North Adams, a copy of which is annexed hereto. Estimated length, 5,600 feet.

5th. Provision and laying of the several permanent pipes in trench, as shown in drawing above described, for power, ventilation, and water supply, through a length of tunnel estimated to be 5,600 feet.

6th. Laying one track complete, including the furnishing iron rails, weighing not less than fifty-six pounds to the yard, chairs, spikes, and cross-ties.

The Commonwealth shall permit the use by the contractors, without charge, for the purposes of the work herein specified, of the dam and canal, water wheels, saw mill, machine shop, with its shafting, lathes, drills, benches and fixtures, compressors, and other machinery for power and ventilation, now set up and in use, with the buildings connected therewith, together with the pneumatic drills, air and water pipes, cross-ties, cars, and drill carriages, which are now in use for the prosecution of the work: stipulating that the contractors shall keep all the same, at all times, in a complete state of repair and efficiency.

The contractors shall hereafter make such repairs, renewals, and additions, as shall appear to the officer in charge of the work necessary for durability or security, or for rapid prosecution of the work.

The Commonwealth will also hand over to the contractors all the tools of every description,—iron rails, steel, iron, powder, horses, mules, wagons, harnesses, and other materials, now provided, which are available for the work, and the contractors shall take and pay for them at a valuation to be agreed upon by the parties to this contract, or in case of their disagreement or failure to act, the valuation shall be made by two competent persons, one of whom shall be selected by the governor and council, and the other by the contractors, the arbitrators to choose an umpire in case of disagreement; said valuation to be fixed upon before the commencement of work.

The Commonwealth will lease to the contractors, at a rent to be determined in the same way, the blacksmith's and other shops, with their fixtures for repairs of tools, cars, etc.

Such further buildings, machinery and material as may be needed for the work shall be provided by the contractors.

The material removed from the tunnel at both ends thereof, will be deposited wherever the Commonwealth, by its officers in charge of the work, shall direct, it being understood that in case the contractors shall be required to deposit the same in embankment or spoil bank on the east of the Deerfield River, they shall have the privilege of using the bridge to be erected by the Commonwealth under such reasonable restrictions as may be required ; and the contractors shall not be required to haul the same more than 3,000 feet from either end of the Tunnel.

The contractors shall from and after the commencement of work under this contract employ the necessary force of miners, laborers, &c., and shall maintain average rates of advance on each of the several sections, described as follows:—

1st. On the tunnel enlargement, 75 feet per month.

2d. On the heading enlargement, 75 feet per month.

3d. Extension of full size tunnel, 125 feet per month.

4th. Excavation and construction of central drain, and laying pipes through the tunnel, 150 feet per month, or not more than 500 feet behind the advanced heading.

The work of each separate section described shall be commenced at the west end of work completed by the State, and thence carried with a completed advance westward, reserving always to the contractors the privilege of working two or more breasts on each one of the sections described, in order to make up the aggregate rate of progress required in each.

Temporary use of timber for covering central drain, as heretofore found convenient, will still be permitted, but permanent stone coverings must be provided and put in place, in advance of any allowance for track-laying.

Estimates will be made only of quantities within the exterior lines prescribed for the tunnel.

Any material detached by blasting or otherwise outside of said lines must be removed by the contractors without charge.

## II.—CENTRAL SECTION.

The work already done consists in the sinking of 583 feet of the shaft, which is intended to have a total depth of about 1,030 feet to floor of tunnel, with such additional depth as may be deemed necessary for a sump.

The shaft is of an elliptical form, 27 feet in diameter on line of tunnel by 15 feet transverse diameter, making an area of about 318 square feet, or  $11\frac{3}{4}$  cubic yards per foot of depth.

*Work to be Done is*

1st. To construct over the shaft a fire-proof floor with self-closing iron hatches.

2d. To repair and complete timbering and finish excavation to present depth of shaft.

3d. To sink the shaft to floor of tunnel.

4th. To set up two 10-inch iron pipes, for purposes of power and ventilation.

5th. To sink the sump below floor of tunnel.

6th. To excavate a tunnel east and west therefrom until it shall meet workings respectively from east end and west shaft.

7th. To construct the central drain, with air and water pipes complete, as shown on drawings exhibited at engineer's office, a copy of which is annexed hereto.

8th. Laying one track complete, including the furnishing iron rails, weighing not less than fifty-six pounds to the yard, chairs, spikes, and cross-ties.

The contractors shall complete the shaft to the floor of the tunnel by the first day of May, 1870.

They shall, before June 1, 1870, furnish and set in place the additional machinery, compressors, &c., requisite to maintain in the power pipe a constant pressure of 50 pounds per square inch while supplying in each heading the continuous working of 8 pneumatic drills, and also provide requisite air-pumps of power sufficient to furnish through the ventilation pipe the proper air supply for the ventilation of each of the headings.

They shall employ suitable force, and shall maintain, after June 1, 1870, an average rate of monthly progress of tunnel excavated to full size, east and west, of not less than 80 feet in each direction.

All excavations from shaft or headings shall be deposited where directed by the engineer.

Price paid per linear foot of depth of shaft will include cost of sinking the shaft and removal of material to spoil banks as shall be required, and of such additional timbering, frame-



work, &c., as may be necessary for arrangement of pumps, hoisting apparatus, and other machinery required.

The contractors will have the privilege of using without charge all the machinery designed for purposes of hoisting, pumping, ventilation, &c., already erected by the Commonwealth, and also the buildings over the shaft, the machine-shop, and machinery, water pipes, drains, &c.

They shall constantly maintain the same in good condition by repairs and renewals, and return the same in good order at the expiration of their contract.

They will supply at their own expense the additional hoisting, pumping, ventilating and drilling machinery which may be required, excavate the spaces for, and furnish tanks, and also place ladders and other constructions and devices for escape and safety as required by the officers of the Commonwealth in charge of the work.

They may occupy and use the saw-mill, and blacksmith's and other shops erected by the Commonwealth, except such as may be reserved by the officers of the Commonwealth in charge—shall keep the same constantly in complete repair, and pay therefor a rent, to be established in same manner as is provided in the case of rents at the east end.

All horses, mules, wagons, tools, steel, iron and iron rails, powder, lumber and other materials provided by the Commonwealth, which are available for their work, shall be taken by them, at a valuation to be fixed upon before they shall commence the work, and to be ascertained, in case the parties do not agree, by arbitrators, chosen in same manner as provided for at east end.

### III.—WEST END SECTION.

The work already done consists of a shaft 318 feet deep, having a section of 8 by 14 feet, from which headings have been extended about 1,609 feet east and westward to west end, and of a supplementary shaft 264 feet distant to the west therefrom and 277 feet deep, used only for purposes of pumping, and of an auxilliary shaft 685 feet farther to the west and 215 feet deep, through which the material of west heading may be hoisted until an opening can be made to west end.



From the present western end of the tunnel, a distance of about 860 feet has been completed by B. N. Farren, contractor, who has existing contracts, upon which he is now engaged and under which he is to complete the tunnel to a point 931 feet east of west end on or before the 1st day of June, 1869.

*The Work to be Done under these Specifications consists in*

1st. Enlargements of the headings already driven, and of the adit to the full size section of the tunnel. Estimated amount—52,800 cubic yards.

2d. Extension of a full size tunnel eastward until it shall meet the workings in opposite direction from the central shaft.

3d. Arching part of the tunnel with sound and hard burned bricks. Amount of bricks to be laid not to exceed 4,500,000.

4th. Construction of the central drain, and in furnishing and laying the air and water-pipes therein.

5th. Excavating for and constructing fifty linear feet of stone arch additional, and joined on to the present west end of brick arch, on such plan as may be furnished by the engineer or engineers, supported on foundations to be approved by the engineer or engineers, and properly filling over the same.

6th. Excavating for and constructing of granite a suitable façade to the tunnel on such plan as may be furnished by the engineer or engineers, to contain about 800 cubic yards, and properly filling around the same.

7th. Clearing out and securely timbering the Haupt tunnel, so called, and maintaining the same until the completion of this contract.

The construction of the stone arch and the façade, being numbers 5 and 6 of the specifications for this section, is not to be commenced until the same is ordered by the governor and council.

8th. Furnishing and laying one track, including rails, chairs, spikes and cross-ties complete, according to specifications for track provided under head of General Stipulations.

The contractors shall employ suitable force, and shall maintain, after May 1st, 1869, an average rate eastward of monthly progress of tunnel excavated to full size of not less than 100 feet.

The contractors will have the privilege of using without charge all the machinery designed for purposes of hoisting, pumping, power and ventilation, &c., already erected by the Commonwealth, and also the buildings over the shaft, machine-shop, with the shafting, lathes, drills, benches and fixtures and machinery, cars, pneumatic drills and drill carriages, water-pipes, drains, &c., stipulating that they shall keep the same at all times in a complete state of repair and efficiency.

The contractors hereafter shall make such repairs, renewals and additions as shall appear to the officers in charge of the work necessary for durability or security, or for rapid prosecution of the work.

The Commonwealth will also hand over to the contractors all the tools of every description—steel, iron and iron rails, powder, horses, mules, wagons, harnesses, and other materials, now provided, available for the work; and they shall take and pay for them at a valuation to be fixed upon before they shall commence the work, and to be ascertained, in case the parties do not agree, by arbitrators, chosen in the same manner as provided for at east end.

The Commonwealth will lease to the contractors, at a rent to be determined in the same way, the blacksmith's and other shops, with their fixtures for repairs of tools, cars, etc.

Such further buildings, machinery and material as may be needed for the work shall be provided by the contractors.

Estimates will be based upon quantity of material which lies within the line of section prescribed by the engineer or engineers, and any material falling from outside of these lines, whether detached by blasts or falls, must be removed by the contractors without charge.

It being understood that where the engineer or engineers shall become satisfied that outside timber support is needed during the construction of the arch, he shall prescribe lines of section one foot outside of brick arch, as an allowance of space for timbering.

Dimensions and thickness of the successive portions of the brick arch will be prescribed by the officers of the Commonwealth in charge of the work, as the same progresses.

Price per cubic yard for excavation of tunnel shall include all cost of temporary supports, pumping, drainage, power, ven

tilation and all material and labor and appliances requisite therefor, in addition to those which have already been provided, —and also cost of hauling and depositing the excavated material as the engineer shall direct.

Price per M for bricks laid in arch shall include cost of timber for support, framing centres, labor, cement, sand, and all materials and labor requisite for making the arch complete.

Quality of bricks, mode of mixing and using mortar, and quality and proportions of cement and sand shall be such as shall be prescribed and approved by the officers in charge of the work.

The contractors shall promptly remove and properly rebuild any work found bad or imperfect, or not in conformity with lines, grades and plans furnished.

All holes or vacancies outside of brick arch must be closely packed with stone of suitable size, by the contractors, without charge therefor.

All suitable bricks made at the State Brick Yard, during the present year, and not required by the Commonwealth or for Farren's contract, shall be supplied to the contractors and taken by them at \$9 per M, the same to be taken out of the amount due upon current monthly estimates.

The bricks are to be delivered at or near the yard, counted in piles, and thenceforward all loss or breakage in transportation or otherwise to be borne by the contractors.

#### IV. — GENERAL STIPULATIONS.

Applicable to each of the foregoing divisions of the work:—

The dwellings and store-houses of all kinds erected at the east end, central shaft, and west end, except such as may be already disposed of or may be reserved by the officers of the Commonwealth in charge of the work, to be rented of the Commonwealth by the contractors, at the same rents as heretofore established, and the amount retained out of their monthly payments.

Measurements definitely establishing the present condition of the tunnel and other work shall be made before the contractors commence upon the same.

Monthly estimates to be made by the engineer or engineers of the amount and value of work done during the month preceding; and at the completion of the work a final estimate shall



be made by the engineer or engineers of the whole amount appearing to be due under this contract.

In case it shall appear at any time during the progress of the work that machinery provided at any point is not longer necessary there for the purposes of the work, then it shall be in the discretion of the officers in charge of the work to remove the same, if it be of the property provided by the State.

The work to be done under the direction and to the entire satisfaction of the governor and council as indicated through the officers in charge of the work.

The contractors shall use their best efforts to keep intoxicating liquors from their employees, and to promote orderly conduct among them; and shall, when required by the engineer, discharge any men who shall be careless, negligent, or incompetent, or guilty of conduct prejudicial to good order.

An employee once discharged for misconduct shall not be again employed upon the work without the consent of the engineer or engineers.

The prices heretofore named for rates of progress provide for all constructions, machinery, material and labor, &c., and for the cost of all accessory works requisite for the completion of the work described in these specifications, all of which shall be supplied by the contractors.

As a more rapid progress of the work is required than drilling by hand labor would accomplish, upon each of the advance headings, between the east portal and west shaft, the contractors will be required to use the pneumatic drills, working continuously not less than eight drills to a heading of eight feet height, with not less than fifty pounds air pressure, but with the liberty to employ the form of machine now in use in the tunnel or any other drill of equal efficiency which they may prefer, and provide at their own expense.

The contractors shall keep the completed portions of their work clear of all obstructions; and shall, whenever required by the engineer or engineers, remove from the tunnel and shaft all machinery, fixtures, and material not needed for their work.

The track to be laid shall in all respects conform with the specifications in Farren's contract for the track of the Troy and Greenfield Railroad east of the tunnel, and shall not be laid or paid until the tunnel is completed.



The parties of the first part shall, at their own cost and charge, cause the buildings and property of the Commonwealth which is allowed to the contractors without charge, to be insured against loss or damage by fire, in such reasonable amounts as shall be approved by the governor and council. The policies to be payable to the Commonwealth in case of loss. All moneys collected on such policies to be applied to the restoration of such property. But in no event is the Commonwealth to be further chargeable for such restoration.

It is understood and agreed, that the Commonwealth is in no event to be responsible for the correctness of the estimates of quantities, distances, etc., given in this schedule, nor shall the specific details of work to be done, as given herein, be construed in any manner to relieve the contractors from the full and complete performance of the entire work of the completion of the Hoosac Tunnel, exclusive of the part now under contract to B. N. Farren, to be performed under this contract, nor in any way affect the gross amount to be paid by the Commonwealth to the contractors, as stated in the contract.

The foregoing schedule, contained in pages 6 to 12, is the schedule referred to in the body of the contract for the completion of the Hoosac Tunnel, executed this day, Dec. 24, 1868.

ALEXANDER H. BULLOCK, *Governor*.  
W. SHANLY.

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COMMONWEALTH OF MASSACHUSETTS.

SECRETARY'S DEPARTMENT, BOSTON, December 24, 1868.

I hereby certify that the above is a true copy.

OLIVER WARNER, *Secretary*.



## HOUSE . . . . No. 323.

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### Commonwealth of Massachusetts.

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HOUSE OF REPRESENTATIVES, March —, 1870.

The Committee on the Hoosac Tunnel and Troy and Greenfield Railroad, to whom was referred so much of the governor's message as relates to the Troy and Greenfield Railroad, report the accompanying Bill.

Per order,

H. J. BARKER.

## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy.

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### AN ACT

Concerning the Troy and Greenfield Railroad.

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:—*

1    SECT. 1. There shall be allowed and paid from  
2 the treasury of the Commonwealth to the Vermont  
3 and Massachusetts Railroad Company and the Fitch-  
4 burg Railroad Company the cost of rebuilding the  
5 bridge in the line of the Troy and Greenfield Rail-  
6 road across the Deerfield River, near the westerly  
7 depot, and of taking care of and protecting that por-  
8 tion of said railroad now under lease to said com-  
9 panies, since the freshet of October last, and a sum  
10 not exceeding eighty-five per cent. of the actual cost  
11 of repairing the injuries caused by said freshet to  
12 said parties of said railroad, the same to be paid after  
13 the completion of said bridge and repairs, and upon  
14 the approval of the bills paid therefor by the governor  
15 and council.



16 In consideration of said injuries to said railroad,  
17 six months' rent thereof is hereby abated.

1 SECT. 2. The governor and council are hereby  
2 authorized to improve the curves and other parts of  
3 said railroad as they may deem expedient: *provided*,  
4 they do not change the general location of the road.

1 SECT. 3. A sum not exceeding one hundred thou-  
2 sand dollars is hereby appropriated for the purposes  
3 named in the foregoing sections.

1 SECT. 4. A sum not exceeding fifteen hundred  
2 dollars is hereby appropriated towards the cost of  
3 making a highway across the land of the Common-  
4 wealth near the east end of the Hoosac tunnel, in  
5 case the same shall be laid out by the county com-  
6 missioners of Berkshire County, to be expended in  
7 such manner as the governor and council shall deter-  
8 mine.

1 SECT. 5. Said railroad companies, together with  
2 the Troy and Boston Railroad Company, are hereby  
3 authorized to make such arrangements and contracts  
4 for business as the directors of said corporations may  
5 deem necessary to secure and facilitate the transit of  
6 both passengers and freight over their line of railroads  
7 between Boston and Troy.

1 SECT. 6. This act shall take effect on and after  
2 its passage.

## Commonwealth of Massachusetts.

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HOUSE OF REPRESENTATIVES, April 27, 1870.

The Committee on Finance, to whom was referred the Bill concerning the Troy and Greenfield Railroad, have considered the same and

### R E P O R T :

The Troy and Greenfield Railroad is the property of the Commonwealth. That part of the road between its easterly terminus at Greenfield and the Hoosac Tunnel was leased to the Fitchburg Railroad Company and the Vermont and Massachusetts Railroad Company, before its completion, by an instrument dated the eighth day of October, eighteen hundred and sixty-six. One of the stipulations of the lease is, that the Commonwealth shall "build said railroad in a substantial manner, corresponding with the average of well-built railroads in New England, and put it in complete condition to operate, furnishing therefor the necessary depot and other buildings along the line." On the other hand it is stipulated "that when the said railroad shall have been completed, the lessees will thereafter keep said railroad in good repair, ordinary wear and tear, and all subsidence and damages arising from the defective and insufficient construction of the road excepted, which shall be repaired by the Commonwealth."

The road had been located in eighteen hundred and fifty-nine, under the management of the Troy and Greenfield Railroad Company. The location was faulty in the extreme. In their report to the governor and council, in eighteen hundred and sixty-three, (Sen. Doc. 93, p. 27,) the State commissioners say of

it, that "the line, as now located, is essentially a contractor's line; such a one as might fairly be anticipated where the contractor and engineer were the same person, intensified, if possible, by his controlling a majority of the stock. Everything has apparently been sacrificed to save present outlay." The engineer employed by the commissioners, says of the location, that "it was adopted evidently with the intention of obtaining the cheapest possible road without reference to its character. There are many cases where even a moderate expenditure for grading would have rendered curves unnecessary or very much increased their radius. The maximum grade going west is 58.6 feet per mile, for a length of 6,700 feet, and coming east 40 feet per mile, for a length of 11,100 feet. The least radius of curvature is 716 feet, of which radius there are 6 curves, embracing a length of 4,192 feet.  $8\frac{28}{100}$  miles in length of the road is on curves of less than 1,000 feet radius. The whole amount of curvature is 4,030 degrees, or more than eleven complete circles, averaging over the whole road 109 degrees to a mile."

In the face of such testimony often reiterated in public documents, this wretched location was substantially retained. The building of the road was subsequently entrusted to a responsible contractor, and the road may be said to have been well built in the ordinary acceptance of that term.

In thus disregarding the character of the location of the road, a great mistake was made by the Commonwealth, for, as has been well said, "a poorly built road on a good location may subsequently be improved and perfected; but a well built road on a poor location can only be remedied by a general relocation and reconstruction."

It is conceded on all hands that when the Hoosac Tunnel is completed, this line of railroad as originally built, will be wholly unsuitable for the business to come upon it, and that several hundred thousand dollars must *then* be expended in its reconstruction. True economy and the interests of the Commonwealth would seem to require that *now*, while the road is so sadly crippled as to be wholly useless, the occasion should be improved for its general relocation and reconstruction. The money spent in restoring it to the condition it was in before the storm, will, in all probability, be wholly wasted, while the amount required for that purpose, judiciously applied with

other moneys in reconstructing a permanent line, would probably do one-fourth of all the necessary work. If it be simply repaired, another storm will beat upon it in due time, and it will again be *washed away*.

The Committee, deeply impressed with these views, has urged them upon the parties in interest, but has urged in vain. The answer is that they cannot wait to rebuild the road, but must have its former condition restored as soon as possible. Sincerely deploring what we deem a short-sighted policy in this regard we pass to another branch of the subject.

The lease of the road was consummated with a full knowledge of the bad character of the location. The lessees took possession of the road in the summer of eighteen hundred and sixty-eight, and continued to operate the same until October fourth, eighteen hundred and sixty-nine. On that day a storm of unusual severity resulted in damages to the road of so serious a character as to raise the question whether the lessees are bound to repair them. No claim is made that the railroad was not "built in a substantial manner, corresponding with average of well built railroads in New England."

Soon after the disaster to the road on the fourth of October, the lessees applied to the governor and council to put the road in repair. This led to a consultation with the attorney-general, as to the obligation of the respective parties to the lease. The attorney-general gave it as his opinion that the Commonwealth is not under the legal duty of making good the damages, but at the same time suggested, as a matter of justice, "that the loss fairly traceable to the unusual and extreme violence of the storm shall be borne by the Commonwealth."

The following is a copy of his communication to a committee of the council:—

#### COMMONWEALTH OF MASSACHUSETTS.

ATTORNEY-GENERAL'S OFFICE, BOSTON, }  
30 COURT ST., Nov. 9, 1869. }

HON. THOMAS TALBOT :

SIR,—I have examined with care the lease of the eastern section of the Troy and Greenfield Railroad to the Fitchburg, and Vermont and Massachusetts Railroad Companies, and considered the views presented by Mr. Richardson before the committee of the council with reference to the damages caused by the recent storm.



It seems to me that in order to throw upon the Commonwealth the legal duty of making good the damages at any particular place, under the strict rules of law, it must be made to appear that the same arose from a mode of construction which, in comparison with the average of well built railroads in New England, and having reference to such contingencies as ought to be taken into account in building such a railroad, would justly be deemed defective and insufficient; and that the word "insufficient," as used in the lease, *is not to receive* so extensive a signification as to make it incumbent on the Commonwealth to repair damages caused by a storm unprecedented in its violence and destructive force, and which would not naturally, or in the exercise of prudent and reasonable foresight, be looked for, taken into account or guarded against in the construction of an average well-built railroad in New England; and that therefore the governor and council have no authority to make such repairs as, under this view, belong to the lessees.

At the same time, this construction, which I think is required by the application of the rules of law, seems to me in this instance, as in others where it has sometimes been applied by court, to be harsh and oppressive upon the occupiers of property belonging to others; and as a matter of justice I quite agree with the report of Mr. Appleton, submitted to me, that the loss fairly traceable to the unusual and extreme violence of the storm should be borne by the Commonwealth, it probably not having been in the minds of the parties at the time of the execution of the lease.

I am very respectfully,

Your obedient servant,

CHARLES ALLEN.

If the suggestion of the attorney-general is to govern the legislature in the disposition of this case, the question next in order is, *What amount of money shall be allowed to the lessees of the road for making the repairs?* In considering this branch of the subject your Committee is aided by the estimates of two engineers, experts in such matters, who were called upon soon after the storm to visit the road, and estimate the damages it had sustained.

One of these was Mr. Appleton, the railroad commissioner. In his report Mr. Appleton says:—

"I had no time to take measures and make calculations based upon them; I merely give the judgment formed in passing along.

Still although there may be variations in detail, I think the aggregate amount will prove to be nearly correct; sufficient at least to make everything as good as it was before, *probably a little better at some points.*"

"I have arranged my estimate of repairs under two heads. \* \* \* It appears to me fair and equitable that the lessee should bear such a proportion of the damages as the injuries from a common freshet might very probably amount to; but that the extraordinary losses caused by an unprecedented rain-fall, should be made good by the owner of the property.

"This principle of distribution, appears to me correct. \* \* \* I have made the distribution to the best of my judgment. \* \* \* I find the total ordinary damages eight thousand four hundred and twenty-five dollars. Total extraordinary, fifty-three thousand six hundred and fifty-one dollars. In all, sixty-two thousand and seventy-six dollars.

"Besides the above injuries to the road, the bridge across the river for common travel, opposite Rice's, was carried off. \* \* \* My estimate for the bridge at Rice's amounts in all to six thousand dollars, but I cannot give any opinion as to who should fairly and properly bear this loss from my entire ignorance about all previous arrangements respecting it."

The other expert, employed by the council in the examination of this case, was A. R. Field, Esq., who had been the engineer of the commissioners in finishing the construction of the road after its location by the original contractors. Mr. Field followed substantially the same classification of damages as was adopted by Mr. Appleton, viz.: *ordinary* and *unusual damages*. The ordinary damages he estimated at six thousand five hundred dollars; the unusual damages, exclusive of the road bridge, opposite Rice's, he put at fifty-eight thousand dollars; the road bridge he calls four thousand five hundred dollars; total damages, sixty-nine thousand dollars.

In closing his report Mr. Field remarks that "where the culverts have been choked up by the debris from above, as is generally the case where the breaks occur in the deep ravines, I have estimated for arch culverts of larger size."

In view of the foregoing estimates and observations, the Committee are of opinion that if the legislature shall decide to adopt the suggestion of the attorney-general, and pay for the

amount of "loss fairly traceable to the unusual and extreme violence of the storm," the sum properly called for will be about fifty-eight thousand dollars.

The committee on the Troy and Greenfield Railroad, and Hoosac Tunnel, in suggesting an appropriation of one hundred thousand dollars for the repair of the road, probably had in view the making of some *slight* improvements in the line and grade of the road as compared with its original construction. They would not only repair the damages resulting from the storm, but put the road in a *little better* condition than it was in before. In the opinion of this Committee, an *expenditure of so limited an amount* for improving the character of the road would be in the highest degree *injudicious*. Believing it to be bad economy to repair the road at all on its present location, they cannot approve of any plan which aggravates the original mistake by adding to the money already invested. Either relocate the road, and thoroughly rebuild it, or simply put it in repair, and refrain from throwing away any new expenditure in the same direction.

The party most interested does not ask for any money beyond the amount estimated by the State officials as necessary to repair the damages "fairly traceable to the unusual and extreme violence of the storm." It was so stated in the committee room.

The Committee see no ground whatever, for allowing to the lessees of the road fifteen hundred dollars for building a highway near the Hoosac Tunnel, as is provided by one section of the bill submitted for their consideration.

It is to be regretted that the present favorable opportunity for correcting a great mistake should pass unimproved. An expenditure of three or four hundred thousand dollars, and a delay of a few months would suffice to rebuild the road, and put it on a footing of respectability as compared with other parts of the line of road between Boston and Troy, and remove the liability to another wholesale disaster like that of last fall. True economy requires that this expenditure be made now. *Short-sighted and temporizing policy* would put it off to some *future time*. While the Finance Committee entertain no doubt as to the proper course to be pursued, they know how hard it will be to sustain these views against the clamorings of parties whose interests would be affected by the delay incident to a

thorough rebuilding of the road at this time, and they accordingly recommend that the sum to be allowed and paid shall not exceed fifty-eight thousand dollars, the same to be used only in restoring the road to the general condition it was in before the storm.

The lease of the road stipulates for a rent of thirty thousand dollars a year. The road will have been interrupted fully six months. If it is right for the Commonwealth to pay for repairing the road, it seems proper that fifteen thousand dollars of the rent should be abated.

The bill is reported in a new draft.

Per order,

D. L. HARRIS.



## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy.

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### AN ACT

Relating to the Troy and Greenfield Railroad.

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows :—*

1     SECT. 1. For the purpose of putting in complete  
2 repair that portion of the Troy and Greenfield Rail-  
3 road, lying between its easterly terminus in Greenfield  
4 and the crossing of the Deerfield River near Hoosac  
5 Tunnel, now under lease to the Vermont and Massa-  
6 chusetts, and the Fitchburg Railroad Companies, there  
7 shall be allowed and paid to said companies a sum  
8 equal to eighty-five per cent. of the actual cost of the  
9 work done and materials furnished therefor : *provided*,  
10 the amount so paid shall not exceed fifty-eight thou-  
11 sand dollars ; and *provided*, that the repairs shall be  
12 conducted under the direction of the board of rail-  
13 road commissioners. No portion of said sum shall be  
14 paid until said commissioners shall have certified to  
15 the auditor of accounts that the railroad has been re-

16 stored to a condition in all respects equal to the con-  
17 dition it was in immediately preceding the great storm  
18 of the fourth day of October, in the year eighteen hun-  
19 dred and sixty-nine.

1     SECT. 2. In view of the damages to be sustained  
2 by said corporations, lessees of said railroad, while the  
3 use of the same shall be suspended, the rent required  
4 by the lease to be paid for its use during a period of  
5 six months is hereby remitted.

1     SECT. 3. The Vermont and Massachusetts and the  
2 Fitchburg Railroad Companies, are hereby authorized  
3 to make such contracts and business arrangements  
4 with each other, and with the Troy and Boston Rail-  
5 road Company of New York, to facilitate the transac-  
6 tion of joint business in passengers and freight for a  
7 period not exceeding the duration of their lease of the  
8 Troy and Greenfield Railroad, as may be agreed upon  
9 by the directors of the several corporations.

No 17

# HOUSE....No. 401.

## Commonwealth of Massachusetts.

AUDITOR'S DEPARTMENT, BOSTON, May 6, 1872.

HON. JOHN E. SANFORD, *Speaker of the House of Representatives.*

SIR:—In answer to an Order of the House of Representatives, which reached me on the 4th inst., asking “what amount of money will have been expended by the Commonwealth on account of the Troy and Greenfield Railroad and Hoosac Tunnel at the time of the completion thereof, provided it be completed according to the terms of the existing contract,” with interest computed to the time of completion as aforesaid, including amounts paid and interest on the same for the Southern Vermont Railway, I have the honor to submit the following statements and estimates, viz.:

State scrip issued by the Troy and Greenfield Railroad Company, while the work was under the control of that corporation, to wit:—

Sterling Bonds, £114,500 at \$4.84,	\$554,180 00
Federal Bonds, . . . . .	216,500 00
Federal Bonds to purchase Southern Vermont Railroad, . . . . .	200,000 00
	<hr/>
	\$970,680 00

Since possession was taken by the Commonwealth, there has been expended to January 1, 1872, including interest on scrip, less materials, &c., sold, . . . . . 7,014,821 04

Total cost to January 1, 1872, . . . . .	<hr/>	\$7,985,501 04
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<i>Brought forward,</i>	\$7,985,501 04
The contract with W. & F. Shanly for the completion of the tunnel was \$4,594,268, of which \$1,477,905.55 had been paid January 1, 1872, leaving balance to be paid of .	3,116,362 45
Estimated cost of railroad from the western portal of the tunnel to the village of North Adams—now under contract,—balance of appropriation made therefor, . . .	164,635 38
Estimated cost for engineering and other expenditures from January 1, 1872, to March 1, 1874, . . . . .	70,000 00
Estimated interest on loans to same date, .	1,100,000 00
Expenditures authorized by the present legislature for graduation and protection of embankments, . . . . .	30,000 00
Premium on and exchange paid and to be paid, estimated at . . . . .	325,735 00
<b>Total, . . . . .</b>	<b>\$12,792,233 87</b>

From this aggregate of estimated cost should be deducted a portion of the Troy and Greenfield Railroad Sinking Fund, which has been created from a percentage of the original loans to the company, from rents, etc., with the accumulations of interest thereon; also the rents reserved in the leases to the Vermont and Massachusetts and Troy and Boston Roads, and a considerable amount of real estate and other property, which may be disposed of after the completion of the Tunnel.

The estimates have been hastily made, though it is believed they will be found tolerably correct.

Very respectfully,

CHAS. ENDICOTT, *Auditor.*



## HOUSE . . . . No. 353.

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**Commonwealth of Massachusetts.**

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HOUSE OF REPRESENTATIVES, April 23, 1873.

The undersigned, members of the Committee on Railways, to whom was referred "An Act to provide for the Consolidation of the Hoosac Tunnel line of Railroads from Boston to Troy," and the petition of the Boston and Lowell Railroad Company for amendment of the charter of the Great Northern Railroad, and many petitions and remonstrances relative to the disposal of the Troy and Greenfield Railroad and Hoosac Tunnel, respectfully submit a

**MINORITY REPORT:**

The Committee, after public notice to all parties in interest, commenced its hearings upon the subject-matter of these petitions on the twenty-ninth day of January, and finally closed them on the twenty-first day of March. Under the authority granted by the legislature, a reporter was employed by the Committee, by whom a verbatim report was made of all the testimony and arguments submitted to the Committee. This has been printed for the use of the Committee and of the legislature, and is now accessible to members.

Many parties were represented by counsel, and various plans were presented.

The first proposal was that of the Troy and Boston, and Vermont and Massachusetts Railroad Companies, for a consolidation under one corporation of the direct line between Boston and Troy..

The second, for a consolidation of the Boston and Lowell and Fitchburg Railroad Companies, with authority to lease or purchase the lines to the tunnel and to Ogdensburg, placing under the control of one corporation about fifteen hundred miles of railroad.

Third, the proposition was urged upon the Committee to provide for the acquisition by the State of the Tunnel Line.

The attendance before the Committee was not limited to the representatives of corporations directly or indirectly interested in the result. Committees of the Board of Trade and other commercial associations, and many private citizens to some extent representing the public interests ; while the larger audiences in attendance upon the sessions of the Committee attested the deep interest of the business community in the subject-matter under discussion.

The problem before the Committee was to determine how the people of this Commonwealth could derive the greatest benefit from the construction of the tunnel which has involved so large a public expenditure.

The relations of the State to this enterprise have greatly changed since its commencement. The tunnel was projected as a private enterprise, which was first aided by the State by a loan of its credit.

It was doubtless then intended that the tunnel when completed should form part of the through line over the Fitchburg, Vermont and Massachusetts, Troy and Greenfield, and Troy and Boston Railroads, to be owned and controlled by these corporations like the rest of the line. This project failed. The Troy and Greenfield Railroad Company was unable with the state loan to complete the tunnel, and after great delays and difficulties, surrendered its railroad and the incomplete tunnel to the Commonwealth, which has since carried on the work at the public charge. Its completion within the current year may be expected and the total expenditure from the treasury of the State will amount, in-

cluding interest, to about \$12,000,000. This expenditure is a charge upon the people and the property of the whole State.

It seems improbable that any disposition can be made of the tunnel which can return to the treasury the whole sum expended, and it is for the legislature to determine how far a return can be made to the people of the State from this great public expenditure, in increased means of transportation and a reduction of rates which are now a burden upon the whole community. Since the tunnel was projected, new lines of railroad have been built which give to nearly every portion of the State direct access to the tunnel and through it to the great West.

In the progress of the hearing certain points were made tolerably clear.

*First*, That the tunnel itself should be so far held and controlled by the State as to insure its use on equal terms by all parties.

*Second*, That some consolidation of the line or lines working through the tunnel was essential to secure efficiency of action, and to provide for the great business awaiting the completion of the tunnel.

*Third*, That to provide equipment and terminal facilities for such a business, the weak and disjointed separate corporations were inadequate, and that it was particularly desirable that some action should be taken at the present session of the legislature.

The policy of direct state ownership was strongly pressed upon the Committee by the railroad commissioners and other parties. The address of Mr. Adams, in behalf of the commissioners, upon this subject, is contained in the printed report, and is a clear and able statement in behalf of this policy. While the experiment has been tried in other States, and under other circumstances has failed, we do not think it is to be condemned for this reason. These experiments were tried before the development of the railroad system, and generally in thinly-peopled States, where state construction of railroads was a political necessity to supplement private capital that could see no inducement for investment.

In the days when state management failed, corporation management failed to quite as great an extent.



The statement of Mr. Adams, in regard to the results of the system in Belgium, are very striking, and in England the current seems to be settling in favor of the assumption of the railroads by the government.

To any careful observer of the railroad development of the past twenty-five years, there can be little doubt of a like progressive increase in this business in the future.

If the benefit of this increase in business can be secured to the people who furnish the traffic, instead of to the corporations who provide the capital, an immense public benefit will follow. The most valuable experiment to be tried at the present day is to ascertain how cheaply railroad transportation can be afforded. Corporations formed to make money for their stockholders, can hardly be expected to fairly try this experiment. The greatest need of this Commonwealth is cheap transportation. To secure this the Hoosac Tunnel has been constructed at a cost of \$12,000,000 of public money.

We are fully convinced that to secure to the people the full advantages to be derived from the construction of this new avenue to the West, and to secure equal rights to all parties desiring to use it, the State must not part with the control of the tunnel. We are equally convinced that to secure efficiency in the lines working through the tunnel, consolidation is necessary, and that the tunnel itself must be worked and managed for all parties using it, by one head.

It would follow that the State, retaining the tunnel, should operate it and should also own or control one line of road between Boston and the West, at the same time giving to all parties, without discrimination, equal advantages in the tunnel. The state management cannot afford to be unjust or to discriminate.

No private corporation can be trusted when its own interests may conflict with the interests of other and perhaps rival corporations, to establish or to enforce rules for the transaction of such business. We therefore report and recommend the passage of the accompanying Bill: "To incorporate the State Board of Trustees of the Hoosac Tunnel Railroad."

Its purpose is to form a corporation for the management of the Troy and Greenfield Railroad and Hoosac Tunnel, with all the powers of a railroad corporation. It is to be composed of



five trustees, to be appointed by the governor and council, each to hold office for five years, and one of whom shall be appointed annually. To these five state trustees are to be added not exceeding three, one by each of the railroad corporations whose property may be acquired or managed under the terms of the Act.

Instead of directly purchasing the railroads constituting the direct line, provision is made for leasing these railroads by the new corporation upon terms which are fair and equitable for all parties. The returns to the railroad commissioners show that the average expense of operating the railroads of this State is seventy-five per cent. of the gross income. We therefore propose to set apart for the benefit of each of these corporations twenty-five per cent. of the gross income of its railroad, out of which shall be paid a yearly rental, and that they may not in any event be losers by the experiment, it is proposed to guarantee to them an amount sufficient to pay to their stockholders the dividends they are now paying, with liberty to increase to the maximum which law or custom permits our railroad corporations to pay.

That such a lease would receive the assent of the companies interested, we have strong reasons to believe.

It secures to the stockholders the dividends they are now receiving. It secures also to them the benefit of any increase of business likely to accrue from the completion of the tunnel, to as full an extent as they can hope to benefit by it. No railroad corporation ought ever to pay more than ten per cent. dividends, and the legislature would undoubtedly, under its power to regulate tolls, interfere to prevent greater dividends.

While these corporations are thus interested in the earnings of the roads, the bill provides that they should be represented in their management. We shall thus secure the services of persons familiar with the local business and history of the separate roads, and although forming only a minority of the board of management, they must have an important influence in the direction of its affairs.

The benefits to be gained by the State by this arrangement are obvious and manifold.

It retains state ownership and management of the tunnel.

It secures to all corporations desiring to use the tunnel equal rights.

It secures to the Commonwealth the full value of its investment, whatever future developments of business shall prove that value to be.

It assumes the establishment of a strong corporation, able to provide all equipment and terminal facilities which any future increase of business may render necessary or advisable.

It meets all the presumed advantages of state acquisition of the railroads, without that disturbance and removal of capital which must follow the purchase of the railroads by the State.

It can furnish capital for the improvement of the line at a cheaper rate than any consolidated company can procure it; and cheap capital in disinterested hands secures *cheap* transportation.

It enables the State to try fairly and fully the experiment of cheap transportation.

It creates a corporation which cannot combine with other corporations, nor can its stock be purchased or in any way controlled by outside parties, and is strong enough to compete successfully with the powerful corporations of neighboring States.

Such a management we believe would be efficient and reliable beyond that of ordinary railroad corporations. It would combine to a great degree the advantages of state and corporate management. The governor and council could be depended upon to appoint suitable persons as trustees. The railroad corporations would naturally appoint their most efficient agents as trustees. Such a board could find no difficulty in securing the services of the ablest railroad officers to direct and aid in the management.

It remains to refer briefly to the other propositions before the Committee.

First, to that of the Boston and Lowell Railroad Company to unite with the Fitchburg. This is a proposal to unite two lines in some degree rival and competing. They are rival lines to some extent for local business. They form parts of rival lines for distant business with the North and West. It is a new proposition in this Commonwealth to unite rival and

competing lines. This competition will be increased with the opening of the tunnel line. The Lowell is the natural terminus of the Northern line, and the Fitchburg is the natural terminus of the tunnel line. Whatever advantages may accrue to the corporations themselves from such a consolidation, the public results will be unmitigated evil. Not one witness unconnected with the interested corporations appeared before the Committee to testify in favor of such a consolidation. The evidence against it was strong and conclusive. The Northern line by way of the Lowell and Vermont Central was shown to be of great value to Boston and to Massachusetts. It is now in a measure consolidated under contracts having twenty years to run, and it is surely bad policy for the Commonwealth, having expended \$12,000,000 to create a new line, to commence its operations with the destruction of one in full and vigorous existence. Moreover, such a consolidation threatens more than anything else state control of the tunnel itself. A powerful corporation, owning the whole line except the tunnel, would soon compel the transfer of that, and until such transfer, would throw upon the State as the owner of the tunnel the responsibility for all the sins and omissions of the line.

The important question of an interchange of depots and tracks by the railroads entering Boston on the north has been somewhat involved in this hearing.

The avoidance of railroad crossings is undoubtedly of great importance, but it has no proper connection with the disposal of the tunnel. The Eastern Railroad Company and Boston and Maine Railroad are agreed what changes can and should be made to avoid these crossings. All that is essential to secure this end is to remove the passenger station of the Fitchburg Railroad west of the Lowell, where it properly belongs. The legislature has full power in the premises. It can, independently of any consolidation, require the Fitchburg Railroad Company to provide passenger accommodations west of the Lowell station, and thus leave its present station on Causeway Street free for the use of the Eastern Railroad Company.

If the State acquires the Fitchburg Railroad under this Act, it can easily provide for the change. The whole question

of interchange of depots is independent of the far more important question of the disposition of the tunnel, and should not control it. If the Lowell Railroad can provide for the wants of the Fitchburg Railroad Company in its passenger station after consolidation, it can do so without consolidation.

Respectfully submitted by

E. P. CARPENTER,  
J. K. BAKER,  
T. W. WELLINGTON,  
WILLIAM BAKER,

*Members of the Committee on Railways.*



## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Three.

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### AN ACT

To incorporate the State Board of Trustees of the  
Hoosac Tunnel Railroad.

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:*

1   SECT. 1. The governor, with the advice and  
2 consent of the council, shall, as soon after the  
3 passage of this act as may be convenient, appoint  
4 five persons, citizens of this Commonwealth, who  
5 shall, on or before the first day of July next, take  
6 the Troy and Greenfield Railroad, and the Hoosac  
7 Tunnel when it shall be completed or surrendered  
8 by the contractors, and all the property and inter-  
9 est of the Commonwealth in the Southern Ver-  
10 mont Railroad Company, and hold the same in  
11 trust for the purposes hereinafter named, one of  
12 whom shall hold his office for five years, one for  
13 four years, one for three years, one for two years  
14 and one for one year, from the                   day of  
15                   . Before the first day of July in  
16 each year, one such trustee shall be appointed

17 for the term of five years; upon the occurrence of a  
18 vacancy before the expiration of a term, an appoint-  
19 ment shall be made for the remainder of such term.

1     SECT. 2. Said trustees are hereby created a  
2 corporation under the name of the State Board of  
3 Trustees of the Hoosac Tunnel Railroad, and shall  
4 have all the powers and privileges, and be subject  
5 to the duties, restrictions and liabilities set forth in  
6 the general laws relating to railroads, so far as the  
7 same may be applicable and not inconsistent with  
8 the provisions of this act.

1     SECT. 3. Before entering upon their duties,  
2 said trustees shall be sworn to the faithful perform-  
3 ance of the same. They shall organize by the  
4 election of a president, clerk and such other offi-  
5 cers as shall be necessary, and they shall prepare  
6 by-laws in accordance with which their meetings  
7 shall be held.

1     SECT. 4. Said board of trustees shall have sole  
2 charge, direction and control, subject to the pro-  
3 visions of this act, of the Troy and Greenfield  
4 Railroad and of the Hoosac Tunnel, when said  
5 tunnel shall be completed or surrendered by the  
6 contractors of the Southern Vermont Railroad,  
7 and of such other railroads as may be leased or  
8 acquired under the provisions of this act. They  
9 shall appoint a treasurer, a general manager, when-  
10 ever they deem such an officer necessary, one or  
11 more superintendents and such other agents as may  
12 be required for the operation of said railroads and  
13 tunnel, and they shall define the duties and fix the

14 compensation of such officers and agents. They  
15 shall establish rates for the transportation of pas-  
16 sengers and merchandise, and make contracts and  
17 arrangements with connecting roads in relation to  
18 joint rates and joint business, and they may do all  
19 other things, not inconsistent with the provisions  
20 of this act and the general laws in relation to rail-  
21 roads, which may be necessary for the efficient and  
22 economical operation of said railroads and tunnel.

1     SECT. 5. Said board of trustees shall hold in  
2 trust all moneys received from the operating of  
3 said railroads and tunnel, and all moneys which may  
4 be appropriated by the Commonwealth for the  
5 completion, extension and improvement of said  
6 railroads and tunnel, and for the equipment thereof,  
7 and shall faithfully apply the same. They shall  
8 annually pay into the treasury of the Common-  
9 wealth the net income received from said roads  
10 and tunnel after the payment of the expenses;  
11 and the same shall be set apart, under the direction  
12 of the governor and council, and applied in such  
13 manner and at such times as they shall direct to  
14 either or all of the following purposes: the extinc-  
15 tion of any indebtedness, or payment of interest  
16 thereon, which the Commonwealth may at any  
17 time incur to carry out the purposes of this act, or  
18 any act in addition to or amendment thereof; the  
19 extinction of the indebtedness, or payment of in-  
20 terest thereon, which has been or may be incurred in  
21 the construction of the Hoosac Tunnel; and the  
22 purchase of stock in any company which shall lease  
23 its franchises, railroad and property in perpetuity  
24 to the corporation herein before created.

1     SECT. 6. Said board of trustees shall make a  
2 semi-annual report to the governor and council  
3 of their doings during the six months next pre-  
4 ceding, and of their receipts and expenditures,  
5 and shall make an annual report to the board of  
6 railroad commissioners in the manner and form and  
7 at the time prescribed for railroad corporations.

1     SECT. 7. Said trustees shall receive, in full  
2 compensation for their services as such, the sum of  
3 three thousand dollars each per annum, except the  
4 president of the board, who shall receive five  
5 thousand dollars, which sums shall be charged to  
6 operating expenses. No trustee shall be appointed  
7 to any office in the employ of said board of trus-  
8 tees, but the general manager, when such officer  
9 shall be appointed, shall be *ex officio* a member of  
10 the said board.

1     SECT. 8. Said board of trustees is hereby au-  
2 thorized to re-locate, where necessary, the tracks  
3 of said Troy and Greenfield Railroad, taking land  
4 therefor in the method prescribed by law in case  
5 of land taken for depot or station purposes, and to  
6 complete, extend and improve the construction  
7 and equipment of said railroad and tunnel, and to  
8 prepare the same in all respects for the reception  
9 of the traffic of a through line.

1     SECT. 9. The sum of five million dollars is  
2 hereby appropriated, to be expended under the  
3 direction of said board of trustees in carrying out  
4 the provisions of this act, to be paid to them from  
5 time to time as the same may be required and



6 called for, by a two-thirds vote of said board of  
7 trustees, on the warrant of the governor. And  
8 for the purpose of providing for said appropriation  
9 the treasurer of the Commonwealth is hereby au-  
10 thorized to issue scrip or certificates of debt in the  
11 name and on behalf of the Commonwealth to an  
12 be amount not exceeding five million dollars, to  
13 sold or disposed of in such manner, and at such  
14 times, and in such amounts, as the governor and  
15 council shall direct. Such scrip shall be redeem-  
16 able in not less than twenty nor more than forty  
17 years from the date thereof, shall bear interest not  
18 exceeding six per cent. per annum, payable  
19 semi-annually, and shall be known as the "Hoosac  
20 Tunnel Railroad Loan"; and the property of the  
21 Commonwealth in the Troy and Greenfield Rail-  
22 road and said tunnel is hereby set apart and  
23 pledged to the redemption of said scrip.

1     SECT. 10. Said board of trustees is hereby au-  
2 thorized, and directed, to lease, in perpetuity, the  
3 franchises and property, and thereafter to main-  
4 tain, improve and operate the railroad, with its  
5 branches, of the Vermont and Massachusetts Rail-  
6 road Company, on the terms following: twenty-  
7 five per cent. of the gross earnings of said leased  
8 railroad and property shall be reserved annually  
9 by said board of trustees as a specific fund out of  
10 which they shall pay to said company, first, a sum  
11 sufficient to pay the interest on the indebtedness  
12 of said company, at the date of said lease, as said  
13 interest becomes due, and, second, a yearly rental  
14 equal to ten per cent. on the present capital stock  
15 of said company, free of all taxes upon the stock-

16 holders or said company (and on any additional  
17 stock, when the same shall be issued for existing con-  
18 vertible bonds), or such a proportion of said rental,  
19 not exceeding said ten per cent. and said taxes as said  
20 reserved fund shall be sufficient to pay: *provided*,  
21 *however*, that in no year shall there be paid to said  
22 company a rental of less than four per cent. on said  
23 capital stock, and said taxes together with the amount  
24 of said interest; and to the payment of such minimum  
25 rental and interest said board of trustees is author-  
26 ized to pledge the faith of the Commonwealth.  
27 Said board of trustees is also authorized to assume  
28 and make provision in said lease for the payment  
29 of the principal of said indebtedness. The surplus  
30 of said reserved fund shall be annually passed by  
31 said board of trustees to the account of earnings.  
32 When said lease shall have been executed, and  
33 while the same continues in force, said Vermont  
34 and Massachusetts Railroad Company may elect,  
35 from time to time, for a term not exceeding five  
36 years, one trustee, who shall be added to said  
37 board of trustees, and, upon being sworn to the  
38 faithful performance of his duties, shall become an  
39 incorporated member of the State Board of Trustees  
40 of the Hoosac Tunnel Railroad; and said company  
41 may fill vacancies for the remainder of the term.

1 SECT. 11. Said board of trustees is hereby  
2 authorized and directed to lease in perpetuity the  
3 franchises and property, and thereafter to main-  
4 tain, improve and operate the railroad, with its  
5 branches, of the Fitchburg Railroad Company, on  
6 the terms following: twenty-five per cent. of the  
7 gross earnings of said leased railroad and property

8 shall be reserved annually by said board of trustees  
9 as a specific fund, out of which they shall pay to  
10 said company a yearly rental equal to ten per cent.  
11 on the present capital stock of said company,  
12 free of all taxes upon the stockholders or said  
13 company, and also on an additional capital stock  
14 of one hundred thousand dollars, which said com-  
15 pany is hereby authorized to issue and hold for its  
16 own benefit, or such a proportion of said rental,  
17 not exceeding said ten per cent. and said taxes,  
18 as said reserved fund shall be sufficient to pay:  
19 *provided, however,* that in no year shall there be  
20 paid to said company a rental of less than eight per  
21 cent. on said capital stock and said taxes; and to  
22 the payment of such minimum rental, said board  
23 of trustees is authorized to pledge the faith of the  
24 Commonwealth. The surplus of said reserved  
25 fund shall be annually passed to the account of  
26 earnings. When said lease shall have been exe-  
27 cuted, and while the same continues in force, said  
28 Fitchburg Railroad Company may elect, from time  
29 to time, for a term not exceeding five years, one  
30 trustee, who shall be added to said board of trus-  
31 tees, and, upon being sworn to the faithful per-  
32 formance of his duties, shall become an incor-  
33 porated member of the State Board of Trustees of  
34 the Hoosac Tunnel Railroad; and said company  
35 may fill vacancies for the remainder of the term.

1    SECT. 12. Said board of trustees is hereby au-  
2 thorized and directed to lease the franchises and  
3 property, and thereafter to maintain, improve and  
4 operate the railroad, with its branches, of the Troy  
5 and Boston Railroad Company, and shall pay



6 therefor an annual rental equal to twenty-five per  
7 cent. of the gross earnings of said leased railroad  
8 and property. When said lease shall have been  
9 executed, and while the same continues in force,  
10 said Troy and Boston Railroad Company may  
11 elect, from time to time, for a term not exceeding  
12 five years, one trustee, who shall be added to said  
13 board of trustees, and upon being sworn to the  
14 faithful performance of his duties, shall become an  
15 incorporated member of the State Board of Trus-  
16 tees of the Hoosac Tunnel Railroad; and said  
17 company may fill vacancies for the remainder of  
18 the term.

1     SECT. 13. In estimating what shall constitute  
2 the said twenty-five per cent. of the gross earn-  
3 ings of said several leased railroads, out of which  
4 their rentals are to be paid, there shall be first de-  
5 ducted from twenty-five per cent. of their respec-  
6 tive gross earnings, six per cent. per annum on all  
7 amounts expended by said board of trustees for the  
8 permanent improvement of said railroads respec-  
9 tively.

1     SECT. 14. Said Vermont and Massachusetts,  
2 Fitchburg, and Troy and Boston Railroad Com-  
3 panies are severally authorized to lease their fran-  
4 chises and property to said board of trustees.

1     SECT. 15. Said board of trustees is further  
2 authorized, with the approval of the governor and  
3 council, to lease or purchase necessary terminal  
4 facilities, and also to lease any railroad lying in the  
5 tunnel route between Boston and Lake Ontario.



1     SECT. 16. In the carriage of through passen-  
2 gers and merchandise, the rates of transportation  
3 shall be estimated pro rata per mile, and the  
4 Hoosac Tunnel shall be estimated at such length in  
5 miles, not exceeding fifty, as shall seem equitable  
6 to the trustees.

1     SECT. 17. In the management of such railroads  
2 as shall come under the operation of said board of  
3 trustees, there shall be no unequal discriminations  
4 in freights, fares or facilities in favor of or against  
5 different persons, places or connecting railroads.

1     SECT. 18. In case of the lease of the Fitch-  
2 burg Railroad under the terms of this act, the  
3 said board of trustees is authorized and directed  
4 to purchase terminal facilities in Boston, westerly  
5 of the freight station of the Boston and Maine  
6 Railroad and to arrange with the Eastern Railroad  
7 Company for an interchange of stations in Boston  
8 in such manner as to obviate the necessity of pas-  
9 senger trains on the Eastern Railroad, Boston and  
10 Maine Railroad and Fitchburg Railroad crossing  
11 the tracks of the other, and the Eastern Railroad  
12 Company is hereby authorized, with the assent of  
13 said trustees, to take or purchase all the land, de-  
14 pot property and buildings of the Fitchburg Rail-  
15 road Company, situated in Boston south of the  
16 channel or passage-way for vessels through the  
17 Fitchburg Railroad bridge over Charles River,  
18 said property to include all the draws and draw-  
19 bridges over the passage-way for vessels.  
20     Also all the property, land and buildings situ-  
21 ated on the south-westerly side of the following

22 line, to wit: beginning at a point on the northerly  
23 side of the above-mentioned passage-way for ves-  
24 sels twenty-two feet nine inches east of the east-  
25 erly line of the roadway draw over said passage-  
26 way, and running northerly at right angles to said  
27 passage-way, one hundred and three feet five inches,  
28 to a point where said line intersects with the north-  
29 easterly line of said Fitchburg Railroad bridge  
30 over Charles River; thence northerly, following  
31 and coinciding with said north-easterly line of  
32 bridge, eight hundred and forty-eight feet; thence  
33 turning and running westerly to a point in the  
34 north rail of the north passenger track of the  
35 Fitchburg Railroad, distant four hundred and six-  
36 teen feet seven inches from the south-easterly line  
37 of Austin Street, measured on said north rail of  
38 the north track. Said point is also distant twenty-  
39 nine feet four inches at right angles from the  
40 southerly side of the wooden freight house (meas-  
41 ured from a point sixty feet distant from the west-  
42 erly end) belonging to the Fitchburg Railroad  
43 Company, on Front Street; thence southerly,  
44 crossing the Fitchburg passenger tracks at right  
45 angles to a point four feet distant south of the  
46 south rail of south passenger track; thence west-  
47 erly on a curved line parallel with the south rail of  
48 the south passenger track, and four feet distant  
49 therefrom to the south-easterly line of Austin  
50 Street in Charlestown. And if the Eastern Rail-  
51 road Company shall so take the said property of  
52 the Fitchburg Railroad Company, then the Fitch-  
53 burg Railroad Company shall take or purchase all  
54 the like property of the Eastern Railroad Com-  
55 pany lying between the crossing of the Eastern

56 and Fitchburg Railroads and Causeway Street in  
57 Boston, except the parcel of land to be taken by  
58 the Boston and Maine Railroad, as hereinafter  
59 provided; and in case of the taking or exchange  
60 of the tracks and property herein before described,  
61 or any part thereof the said Fitchburg Railroad  
62 Company shall locate and construct such tracks  
63 and bridge structures on the westerly side of the  
64 present line of the Eastern Railroad as may be  
65 necessary to connect its railroad and tracks with  
66 the tracks and property so purchased or taken by  
67 it; and shall not thereafter cross either said East-  
68 ern Railroad or said Boston and Maine Railroad  
69 except for freight purposes.

70 And the Eastern Railroad Company shall locate  
71 and construct such tracks and bridge structures as  
72 shall be required to connect its present tracks  
73 northerly of its crossing with the Boston and  
74 Maine Railroad with the tracks and property so  
75 purchased or taken by it, keeping at all times east  
76 of a line drawn from a point on the easterly side  
77 of its present location, distant southerly three  
78 hundred and fifty feet, measured on said line from  
79 its intersection with the southerly side of Cam-  
80 bridge Street to the point of intersection of the  
81 northerly line of the state prison wharf with the  
82 easterly line of the location of the Boston and  
83 Maine Railroad, and thence keeping east of said  
84 easterly line of said location; and shall not there-  
85 after cross the tracks of the Boston and Maine  
86 Railroad.

87 And the Eastern Railroad Company shall take  
88 any lands now belonging to the Boston and Maine  
89 Railroad in Charlestown or Somerville lying east-



90 erly of such new location; and the Boston and  
91 Maine Railroad shall take all the road-bed, land  
92 and property of the Eastern Railroad Company  
93 lying between the line above described for the  
94 westerly limitation of said new location of the  
95 Eastern Railroad and the westerly line of the  
96 old location of the Eastern Railroad, and the  
97 present northerly line of the Fitchburg Rail-  
98 road: *provided, however*, that in case of the  
99 aforesaid taking and exchange of property by  
100 and between the Eastern and Fitchburg Rail-  
101 roads, the Boston and Maine Railroad shall  
102 release the Eastern Railroad Company from all  
103 damages for its taking and occupation there-  
104 of and take from the said Eastern Railroad Com-  
105 pany so much of the premises described in the  
106 first section of the three hundred and fifty-sixth  
107 chapter of the acts of the year eighteen hundred  
108 and seventy-two, as was taken from the said  
109 Boston and Maine Railroad by said Eastern Rail-  
110 road Company under the provisions of that act;  
111 and said Eastern Railroad Company shall, with-  
112 out other compensation therefor, release to said  
113 Boston and Maine Railroad all their rights in  
114 said premises acquired by them, taking the same  
115 under said act; and *provided, further*, that any  
116 exchange of land made under the provisions of  
117 this section shall take effect simultaneously.

118 All general laws relating to the taking of land  
119 for railroad purposes and to the location and con-  
120 struction of railroads, shall be applicable to and  
121 govern the proceedings in the taking and ex-  
122 change of lands and property, and in the making  
123 of any new locations under the provisions of the



124 foregoing sections, except that instead of the  
125 county commissioners three disinterested persons  
126 shall be appointed by the supreme judicial court  
127 for the county of Suffolk as a board of commis-  
128 sioners to determine the values of the lands and  
129 property so taken and exchanged or over which  
130 any such location may be made, and to adjudicate  
131 the damages to be paid by any of the others upon  
132 the taking, exchange or locations aforesaid, from  
133 whose decision an appeal shall be to a jury in be-  
134 half of either party, as provided by law in the  
135 case of lands taken for railroad purposes.

136 Any sum of money received by the Fitchburg  
137 Railroad in said interchange of stations and  
138 tracks above the expense of necessary alterations  
139 shall be applied to procuring new terminal facil-  
140 ities and making improvements on said road or  
141 may be applied to the reduction of the capital  
142 stock of the Fitchburg Railroad Company in  
143 such manner as may be agreed between the  
144 Fitchburg Railroad Company and said board  
145 of trustees.

1 SECT. 19. This act shall take effect upon its  
2 passage.



No 19

## SENATE . . . . No. 112.

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### Commonwealth of Massachusetts.

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IN SENATE, March 9, 1874.

The Joint Special Committee, to whom was referred that portion of the governor's message which relates to the Tunnel Line of Railroad,

### REPORT :

That, in investigating the relations of the Commonwealth and the various lines of railroad, recognized by previous legislation as component parts of a continuous line from Boston to Troy, and also the relations of other roads and interests, either directly or remotely to be affected by the formation of such line, the Committee elected to rely primarily upon information obtainable from the numerous Acts of the legislature heretofore passed, and from the vast array of facts and opinions which the subject has heretofore elicited, and which are comprised in the public records and documents; and to supplement the same by such additional evidence and public hearings, as might thereafter be found necessary or desirable.

The Committee have found these documentary sources of information so ample and exhaustive, and the previous legislation in some respects so specific and controlling, that they have been enabled to arrive at their conclusions without recourse to the alternative which they would otherwise have

cheerfully accorded to parties willing to contribute their assistance.

As a detailed review of these acts and documents, however interesting as a narrative, would complicate rather than simplify the facts and reasons which have governed the Committee, reference will be had to such only as bear directly on the great problem to be solved, viz. : the formation of a continuous line, with a common ownership, and an efficient, compact management, on such basis that the legal and equitable rights of the Commonwealth and the several roads primarily interested, shall be preserved ; that equal rights, benefits and privileges shall be accorded and secured to other organized, and also to future roads ; that the public welfare and the commercial interests of our citizens shall be protected and promoted, and that these results shall be attained with certainty, without violating plighted faith or existing contracts, and without compulsory or coercive intervention with the rights or interests of any persons or parties.

The enterprise of connecting Boston and Troy by rail, *via* Fitchburg and the Hoosac Tunnel, has been vigorously pursued for over a quarter of a century, and though entered upon with a buoyant zeal, its advocates were soon compelled to seek the aid of the Commonwealth in overcoming the barrier presented by the Hoosac range.

The legislature of 1854, regardful of the claims of the portion of the State to be benefited, though beguiled by the estimates and figures presented, authorized a loan (by chapter 226) of two million dollars to the Troy and Greenfield Railroad Company, for which the Commonwealth should, and subsequently did, receive a mortgage of the "entire railroad of said corporation, its franchises, income and property," together with "all interests of said railroad company in the Southern Vermont Railroad,"

This mortgage attracted the early attention of the Committee, owing to a right of redemption specifically reserved by statute (Acts of 1862, chapter 156, sect. 2) to the Troy and Greenfield Railroad Company for "ten years after the said road and tunnel are completed and the same opened for use." A question of great magnitude and importance here arose, as to whether the sum to be paid under this right of redemption



should embrace the amount of the original loan (\$2,000,000) and interest only, or the full amount expended, and to be expended, by the Commonwealth in the completion of the road and tunnel, with interest thereon.

This question was referred by Resolution of the Senate to the attorney-general, who, in an opinion hereto appended (marked A), says: "Such redemption can only take place upon the repayment to the Commonwealth of all sums necessarily and properly expended in completing, preserving and making productive the property."

Accepting this opinion of the attorney-general as establishing the right of the Commonwealth, as mortgagee in possession, to act substantially as owner of said railroad and tunnel, without hazard to such other railroad interests and properties as might become associated with it in the formation of a through line, the Committee proceeded to examine the various Acts of previous legislatures, to ascertain what action, if any, may have been had which should now influence or control the conclusions of the Committee as to the railroads entitled to be regarded as component parts of the through line from Boston to Troy. This examination developed so clearly the policy and intentions of the Commonwealth in this regard, that the Committee deem it proper to present the facts in considerable detail.

Acts of 1848, chap. 307. Sect. 2, "incorporates the Troy and Greenfield Railroad Company, and authorizes it to construct, etc., a railroad from Vermont and Massachusetts Railroad to a point on line of the State of New York, *to meet or connect with any railroad that may be constructed therefrom to Troy.*"

Sect. 8. "The said corporation may run conjointly,—may lease or let to any contiguous road which composes a part of the *railroad line between the cities of Boston and Troy, of which the railroad hereby authorized shall be part.*"

Acts of 1852, chap. 297, "authorizes union between Troy and Greenfield Road and Southern Vermont Road."

Acts of 1859, chap. 117, directs Troy and Greenfield Railroad and Hoosac Tunnel, "to be constructed in such manner as will permit the convenient use of the same in the transportation of passengers and freight between the cities of Boston and Troy."

- Acts of 1860, chap. 156. Sect. 8, "requires Troy and Greenfield Railroad Company to purchase Southern Vermont Railroad, *subject to its perpetual lease to the Troy and Boston Railroad Company.*"
- Acts of 1862, chap. 156. Sect. 4. Commissioners "may lease that portion of Troy and Greenfield Railroad, east of Hoosac Tunnel, to the *Vermont and Massachusetts, the Fitchburg or the Troy and Boston railroads, or either of them, until completion of the said tunnel.*"
- Acts of 1863, chap. 214. Sect. 1. Commissioners authorized "to construct, complete and equip the Troy and Greenfield Railroad and Hoosac Tunnel, and to make such alterations in the line of said road as may be deemed necessary to *render it suitable and proper for a part of a through line from Boston to Troy.*"
- Sect. 6. "The contract executed by the *Troy and Boston, the Vermont and Massachusetts and the Fitchburg Railroad companies,*" whereby the said companies severally agree to pay to the Commonwealth twenty per cent. of certain gross earnings received by them, is "*hereby approved, ratified and confirmed.*"
- Acts of 1870, chap. 252. Sect. 4. "Said railroad companies, (Fitchburg, Vermont and Massachusetts, and the Troy and Greenfield, being referred to), together with the *Troy and Boston Railroad Company,* are hereby authorized to make such arrangements and contracts for business as the directors of said corporations may deem necessary to *procure and facilitate the transit of both passengers and freight on their line of railroads between Boston and Troy.*"

In view of this accumulation of evidence that the Commonwealth, in the formation of the Troy and Greenfield Railroad Company originally, and in its own undertakings subsequently, to construct, complete and equip said railroad and the Hoosac Tunnel, acted with the purpose of making a through line from Boston to Troy, *via* the Fitchburg, the Vermont and Massachusetts, the Troy and Greenfield and the Troy and Boston Railroads; and in view of other evidence that the said railroad companies have concurred and participated in such purpose, the Committee have felt constrained to shape and direct their action, primarily, to the formation of such through

line, by a plan which shall embrace said railroads, or such of them as shall elect to become parties to it, but which shall not exclude other roads, whether already built or hereafter to be constructed, from participating on equal terms with said roads or either of them in the benefits of an open communication with the State of New York, and through its system of internal improvements with the great West.

Proper and just as the Committee have considered a regard for the rights of the said companies to be, and confident as they feel of the ultimate concurrence of the companies in the plan, they have deemed the interests of the Commonwealth and of the community too deeply involved in the immediate and most favorable utilization of the tunnel to allow its use to depend upon the contingent action of said companies or either of them; hence they have provided such alternative measures, by lease, by contracts, and otherwise, as in their opinion cannot fail to secure, at the earliest practicable time, connection by rail of Boston, the Hudson River and the West through the Hoosac Tunnel.

The *intention* of the Commonwealth to construct and complete the Troy and Greenfield Railroad and the Hoosac Tunnel, is abundantly manifested in several of the Acts above referred to; its *obligation* to do so is explicitly expressed in a contract (a copy of which is appended marked "B"), made by its authority by James M. Shute and Alvah Crocker, commissioners appointed in accordance with Acts of 1862, chapter 156, whereby said commissioners lease to the Vermont and Massachusetts and the Fitchburg companies that portion of the Troy and Greenfield road east of the tunnel, and in behalf of the Commonwealth agree "to build said railroad in a substantial manner corresponding with the average of well-built railroads in New England, and to put it in complete condition to operate, furnishing therefor the necessary depots and other buildings along the line, and also suitable turntables at Greenfield, Shelburne Falls and the tunnel, and building suitable side-tracks not exceeding one mile in all," and further declare that "it is understood and agreed that the Commonwealth will proceed with all reasonable and practicable despatch in constructing the Hoosac Tunnel," etc., etc.

The obligation of the Commonwealth to construct or com-



plete the Troy and Greenfield Railroad and the Hoosac Tunnel is further and more positively affirmed by the legislature in Acts of 1863, chapter 214, section 6, wherein the Commonwealth *approved, ratified and confirmed* the contract executed by the Troy and Boston, the Vermont and Massachusetts and the Fitchburg Railroad Companies, by which they severally agree to pay the Commonwealth certain portions, twenty per cent., of their gross earnings received for business passing to or from the Troy and Greenfield Railroad "*in consideration that the Commonwealth of Massachusetts shall construct or complete, or cause to be constructed or completed the said Troy and Greenfield Railroad and Hoosac Tunnel.*" A copy of said contract is appended, marked "C."

This contract is commended to the especial attention of the legislature, as, apart from the other considerations enumerated in this Report, it has materially influenced the scope and direction of the action of the Committee.

At the time this contract was approved by the legislature the Commonwealth was mortgagee in possession of all the rights, properties and franchises of the Troy and Greenfield railroad; it was also trustee for all parties having legal rights to net earnings and income (see Acts 1862, chapter 156, section 6); and by this act it became practically contractor and banker; and in these manifold relations is subject to the various provisions of the contract and entitled to its benefits.

In pursuance, either of its previously declared policy, or of the obligations of this contract, the Commonwealth has proceeded hitherto with the construction of the road and tunnel, and at an early date will be entitled to call on the said railroad companies for a specific performance of their several agreements. Under the altered conditions in railroad business which have arisen since the contract was made, and which have increased the ratio of expenses to gross earnings, such specific performance may be so onerous as to call for the relief of the several companies until such conditions shall have again become more favorable, or to cause an increase of their transportation tariffs, which in turn would defeat the chief purpose of the construction of the tunnel, namely, the the creating of a competing line of railroad between Boston and the West, which, by cheapening transportation would



cheapen the cost of breadstuffs, &c., to the people of Massachusetts, and thereby promote its great industrial interests.

The full value of this contract to the Commonwealth, substantially the owner of the Troy and Greenfield Railroad and Hoosac Tunnel, whether these properties shall or shall not be placed in a trust as recommended by the Committee, it is impossible to appreciate or estimate, inasmuch as a condition of things may arise beyond the jurisdiction of the Commonwealth, which, except for this contract, may render the Hoosac Tunnel a monument of the energy and perseverance of Massachusetts rather than of its wisdom; as its western portal may become a perpetual western terminus.

The Committee have not hesitated to assume that the Commonwealth, though intensely solicitous for the success of the tunnel enterprise to its utmost promise, and for the most ample return for its vast expenditures compatible with such success, would unhesitatingly hold such return and all other considerations, subordinate to its plighted faith, whether expressed or implied, and to whomsoever given, and have become fully satisfied that these considerations will require that the Commonwealth shall seek for a large portion of its return in the prosperity of its people, to be enhanced by its concessions. Hence the Committee have devised a plan for the formation and operation of a through line from Boston to Troy, in which *value rather than cost* is the elementary principle; a plan thus liberally proffered is entitled to the confidence and hearty acceptance of all other parties disposed to carry out in good faith their obligations, or to make proper contributions or concessions to the public interests and welfare; a plan thus designed, and dependent in a large degree for its success upon the voluntary coöperation of other parties, must assert the propriety of an original control by the party who makes the first and the greatest concession, who invests his property, and invites others to become associated as joint and ratable proprietors, without exacting any preference, and with a reasonable participation in the management.

The plan presented by the Committee, though formed with a due regard to the limitations of good faith and existing contracts, answers to this description. It creates a trust,

defines the number, duties, mode of appointment, and general powers of the trustees; vests in them as a body corporate all the franchises, rights, estate, &c., of the Troy and Greenfield Railroad Company and the Hoosac Tunnel belonging to the Commonwealth, and prescribes the power and authority they may exercise. It directs the trustees thereafter to proceed to negotiate for the merging in the trust of the roads and properties of the Troy and Boston, the Vermont and Massachusetts, and the Fitchburg Railroads, so as to bring the same under the common ownership and management of the trustees; it defines the basis upon which such negotiations may be conducted, so as to determine the interest in the trust property then held by the trustees (expressed by fractions) which, upon any such negotiations being finally consummated, shall belong respectively to the owners of the roads which shall be merged, and to the Commonwealth. This basis for participation is made upon what is commonly known as an equation of traffic capacity, that is to say, the measuring of the several roads, and also the Troy and Greenfield and Tunnel by a common standard, whereby their relative values will be determined and their working lengths fixed by their respective abilities to transport a prescribed amount of tonnage, greater or lesser distances, for a fixed sum of money. For illustration: assume the length of the Vermont and Massachusetts Road to be 50 miles; that owing to high grades and short curves, the tonnage which it could transport over its road at an ascertained cost, could be transported 100 miles over the ideal (say straight and level) standard road, its traffic length would therefore be but 25 miles, though its real length is 50. By a similar process, the traffic length of the Troy and Greenfield might be ascertained to be but three-fourths of its real length, say 33 miles. If merged in the trust therefore, all other conditions having been found satisfactory to the trustees, the Commonwealth would own thirty-three fifty-eighths, and the Vermont and Massachusetts twenty-five fifty-eighths of the joint properties. The managers of the Vermont and Massachusetts would, however, require some more convenient declaration of their interest in the trust than such fraction, in order that distribution might be made among their share-

holders. Provision for this is made by an issue of trustees' certificates,—answering to stock certificates,—for the precise amount of their interest in the joint property as expressed also by such fraction. The plan having been thus put in operation, in case the other roads shall desire to merge their properties in the trust, after negotiations are satisfactorily concluded, the trustees would issue trust certificates for the amount properly deliverable, the total amount of certificates theretofore issued being thereby increased, a corresponding increase is made by the operation of the plan, of the denominator which regulates the proportions of interests of all certificates; whereby a perfect equilibrium is maintained; as value in property comes into the trust, when trustees' certificates representing precisely equal value are issued. The trustees are to proceed in like manner as to issuance of certificates in other cases which may arise whereby they may acquire other railroad properties for the trust. Notwithstanding these equal and just arrangements for admitting the several roads entitled, into the common ownership or trust, it may happen that some or all may decline to enter into the arrangement. The business must nevertheless come forward, the tunnel must be utilized; it must not be left isolated until an entire new line of roads can be built, nor until the Commonwealth can be forced to make such terms with the existing roads as their presumed advantages of position may lead them to dictate, even though gilded with seemingly fair offers for sale by appraisals, which however plausibly provided to be made, may be based on fictitious valuations already prepared, or to be manufactured for the occasion. The trust, in such contingencies, provides for a lease by the trustees, of the roads necessary to form the line. In case of inability to effectuate a lease, then running or traffic contracts may be made with such roads; these failing, the trustees may acquire direct ownership by purchase of shares in open market, to such extent as may be requisite to provide a lawful and certain remedy.

The plan contemplates that the trust shall be self-sustaining; no liability of any name or nature may be imposed on the Commonwealth or the certificate holders; whatever monetary facilities may be required are to be obtained, as in all



other railroad operations, on the faith and credit of the trust property, and no part of it is to be regarded too sacred to be used properly and lawfully, to equip, maintain and operate the road and carry out the purposes of the trust.

The plan makes ample and certain provision for the interests of connecting, and even distant roads having business with the line, whereby favoritism is precluded and all enjoy equal benefits and facilities.

The plan provides a practicable process for its amendment, when required, and although the corporation will be subject to all general laws relating to railroads and amendments thereof, special legislation, except as provided for, is excluded by the very nature of the arrangement, which brings into a common agreement, parties and properties belonging to different States. The Committee deem it unnecessary to amplify more in detail a plan designed, like a piece mechanism, to operate successfully continuously and without appreciable friction, or to further enlarge this Report by extended allusions to the vast business and public interests involved in this great transportation problem, or by specific reference to the varied and conflicting local interests to be affected by any wise solution of it.

The Committee accordingly report the accompanying Bill.

EDW'D LEARNED.

JONATHAN A. LANE.

CHARLES HALE.

EDWARD DICKINSON.

SAMUEL O. LAMB.

R. NOBLE.

S. W. BRAYTON.

JOHN F. HASKINS.



[ A. ]

## OPINION OF THE ATTORNEY-GENERAL.

ATTORNEY-GENERAL'S OFFICE, BOSTON, }  
7 COURT SQUARE, Feb. 3, 1874. }HON. GEORGE B. LORING, *President of the Senate.*

SIR:—I have the honor to transmit herewith my reply to the questions propounded in the joint order of the two Houses, adopted on the 22d ult.

I am, very respectfully,  
Your obedient servant,

CHAS. R. TRAIN.

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Under the provisions of chap. 226 of the Acts of 1854, the Troy and Greenfield Railroad Company executed a mortgage to the State, bearing date July 28, 1855. This was given as security for a proposed loan of the scrip of the State to the company to the amount of \$2,000,000, to enable the company to construct a tunnel and railroad under and through the Hoosac Mountain. This mortgage, known as the first mortgage, had the sanction of the legislature, and its validity has never been denied.

On the 30th of July, 1855, a second mortgage was executed by the company to J. V. C. Smith and others, trustees, to secure the payment of bonds of the corporation. The validity of this mortgage was denied, and subsequently, upon a bill in equity brought by the Commonwealth to test the question, the supreme judicial court decided the mortgage to be invalid, and the bonds void. (*Vide* Commonwealth *v.* Smith and others, 10 Allen, 448.)

On the 6th of July, 1860, under the provisions of chap. 202 of the Acts of that year, a second mortgage was executed by the company to the Commonwealth.

On the 5th of March, 1862, a third mortgage was executed by the company to the Commonwealth, of the value of which, as in

creasing the security of the Commonwealth, it is not necessary now to inquire. These are all the mortgages or liens ever created by the company, so far as I know ; and since the decision of the supreme court upon the validity of the Smith mortgage, there are no parties, so far as I can ascertain, who have any claim upon the property of the company, by way of lien, or otherwise, adverse to the State. Nor is there any party who claims, or could enforce, a right of redemption from the Commonwealth, unless the company itself may do so.

By chap. 156 of the Acts of 1862, sect. 2, "the Troy and Greenfield R. R. Co. is hereby authorized to surrender to the State the property now mortgaged ; but the right of redemption shall not be barred until ten years have elapsed after said road and tunnel are completed and the same open for use. The said commissioners shall, immediately, in the name of the Commonwealth, take complete possession under the mortgages to the Commonwealth given by the Troy and Greenfield R. R. Co., of all property, rights and interests intended to be conveyed by said mortgages, or either of them, and then shall, without unnecessary delay, cause the said railroad to be completed and put into running order." \* \* \*

Under the provision of this Act, the company surrendered its road and property to the Commonwealth on the 4th of September, 1862, and since that time the Commonwealth has been in possession under its several mortgages, with a title pronounced by the highest professional authority most unquestionable.

In January, 1863, the whole amount expended upon the road and tunnel was about \$2,000,000. Of this sum, the State had advanced \$953,695, exclusive of interest (*vide* Message of Governor Andrew, 1863, Sen. Doc. 93), and the company the balance.

The State was in possession of a piece of property unfinished in every particular. Expenditures already incurred must be entirely lost, and the security of the State destroyed, except by the expenditures of sums of money largely in advance of the amounts secured by the mortgages, and these expenditures, if made upon the road east of the Hoosac Mountain, without the completion of the tunnel, were of no value as security to the Commonwealth, or the corporation itself.

In June, 1863, and before the Commonwealth had entered upon an expenditure exceeding the \$2,000,000 named in the first mortgage, His Excellency Gov. Andrew and the executive council obtained the opinions of the Hon. Dwight Foster, then attorney-general, Ex-Gov. Emory Washburn and the Hon. Isaac Redfield upon all the points which were at that time suggested by the executive department and the commissioners under the Act of 1862, in

which the rights and obligations, present and future, of the Commonwealth could be involved, and the future of the State in the completion of the road and tunnel were considered with the gravity, deliberation and ability due to the magnitude of the interests involved. These opinions, with the exception of that of Gov. Washburn, remain in the executive department.

In the very elaborate, learned and exhaustive opinion of Judge Redfield, he says :—

“ In regard to the right of the Commonwealth to finish the road and insist upon holding the prior claim upon it to the full extent of all their advances, perhaps nothing more need be said. Upon general principles such advances, made by a mortgagee in possession, by way of permanent erections, would not be a valid claim, even as against the mortgagor. But necessary repairs are a valid claim both against the mortgagor and subsequent incumbrances. And permanent erections, made by consent or acquiescence of the mortgagor and of subsequent incumbrancers, or while they lie by and do not object to such erections being made, are also a valid prior claim upon the estate. And in one case, when the estate consisted of a building-lot, which was unproductive, a permanent building erected at the expense of \$5,000, was held a valid claim on the part of the first mortgagee in possession. (*Montgomery v. Chadwick*, 7 Clarke (Iowa), Rep. 114.)

“ And in the present case I should expect a court of equity, if it made any decree in advance, to direct that unless subsequent claimants removed the claim of the Commonwealth, in some short and reasonable time, to be fixed by the court, they be allowed to proceed and put the road in operation, and to hold a prior claim upon all the property, real and personal, for their expenditures in that behalf. And if that course were pursued by the Commonwealth, by giving notice to all subsequent claimants, without obtaining any previous order from the court for thus doing, and the subsequent claimants should afterwards succeed in establishing a right to redeem the interest of the Commonwealth, I should entertain no question they would be required by a court of equity to pay all sums which the Commonwealth had been compelled to advance in order to render the property productive.” (1 Redfield's American Railroad Cases, 575.)

For other authorities, see, also, 2 Story's Eq., 11th ed., §§ 235 and 236 ; 2 Washburn on Real Prop., 3 ed., 210, and cases cited.

The elements of preëxisting liens, and the Smith mortgage, which were so largely considered in the opinions of the eminent counsel in 1863, no longer embarrass the case, and the only party with whom the State has now to deal, is the Troy & Greenfield Railroad Company.

The legislation by which the State became the mortgagee in possession was at the request, and with the consent of the company.

The instrument by which the company and the contractors surrendered the road to the State contains a binding consent, either express or implied, that the Commonwealth may proceed to finish and equip the entire road including the tunnel, and that the company only reserve the right to redeem within ten years after the road is completed and put in operation, by paying all sums advanced by the Commonwealth, and interest thereon, deducting the net earnings of the road.

The legislation since the State took possession of the road, is all based upon this expectation, and has been enacted with the full knowledge of the company, and without protest or objection on its part.

The expenditures by the Commonwealth in completing and preserving the road and tunnel down to the date of the Shanly contract, were largely made by a commission, of which the Hon. Alvah Crocker, a director and president of the company, was the head, so that the company has had actual notice of everything that has been done by the State, and has acquiesced and thus consented to every step which has been taken by the State towards the completion of the road and tunnel, if any notice was necessary. The last return made by the company is for the year ending November 30th, 1863, and the last meeting of the company was its annual meeting in 1865.

Under these circumstances, upon principle and authority, I am of the opinion, that if the Troy & Greenfield Railroad Company shall upon the completion of the road and tunnel, establish a right to redeem, such redemption can only take place upon the repayment to the Commonwealth of all sums necessarily and properly expended in completing, preserving and making productive the property.

CHAS. R. TRAIN.



[B.]

LEASE OF THE EASTERN SECTION OF THE TROY AND GREENFIELD RAILROAD TO THE FITCHBURG AND VERMONT AND MASSACHUSETTS RAILROAD COMPANIES.

THIS AGREEMENT, made and entered into this eighth day of October, in the year eighteen hundred and sixty-six, by and between the Commonwealth of Massachusetts, by James M. Shute and Alvah Crocker, commissioners appointed according to the provisions of an Act providing for the more speedy completion of the Troy and Greenfield Railroad and Hoosac Tunnel, approved April 28th, 1862, being chapter 156 of the Acts of that year, party of the first part, and the Fitchburg Railroad Company and the Vermont and Massachusetts Railroad Company, party of the second part, witnesseth that

*Whereas* the said party of the first part is about to proceed with the construction of the Troy and Greenfield Railroad from Greenfield to the Hoosac Tunnel,

*Now, therefore*, the said party of the first part agrees to let and lease unto said party of the second part said railroad when finished, together with the depot and other buildings, and turn-tables, to be constructed upon the line thereof, as hereinafter stipulated.

And the said party of the first part agrees to build said railroad in a substantial manner, corresponding with the average of well-built railroads in New England, and to put it in complete condition to operate, furnishing therefor the necessary depot and other buildings along the line, and also suitable turn-tables at Greenfield, Shelburne Falls, and the Tunnel, and building suitable side-tracks, not exceeding one mile in length, in all.

And the said party of the second part agree and bind themselves to pay for the use of said railroad, from and after the time when

the same shall have been completed as far as Shelburne Falls, the sum of twenty thousand dollars annually, and from and after the time when the said railroad shall have been completed from Shelburne Falls to the Tunnel, the further sum of ten thousand dollars annually.

And the said party of the second part agree, that when the said railroad shall have been completed as far as Shelburne Falls, they will thereafter keep said railroad in good repair as far as Shelburne Falls, ordinary wear and tear, and all subsidence and damages arising from the defective and insufficient construction of the road excepted, which shall be repaired by the Commonwealth; and when said railroad shall have been completed as far as the Tunnel, they will keep the whole of said railroad, from Greenfield to the Tunnel, in good repair, with like exceptions.

It is agreed that freight shall be carried over said railroad for the Commonwealth at prices not exceeding those usually charged for like freight, transported for like distances, on the Fitchburg and Vermont and Massachusetts Railroads.

It is understood and agreed that the Commonwealth will proceed with all reasonable and practicable dispatch in constructing the Hoosac Tunnel, and that in case of the suspension of work thereon, brought about by action of the legislature, or other competent authority, this agreement may then be vacated at the option of either party thereto, upon written notice given by either party thereto to the other; but any amounts due under the same for rent at the time when such notice may be given, shall remain due and payable, notwithstanding that this agreement has been vacated; otherwise this agreement shall continue in force until the completion of the Hoosac Tunnel.

The rent stipulated for herein shall be payable by the party of the second part to the party of the first part, quarterly, on the first days of January, April, July and October in each year, and upon the termination of the agreement proportionately from the last quarter-day.

In testimony whereof, the said Commonwealth, by the said commissioners, and the said Fitchburg and Vermont and Massachusetts Railroad Companies, by their respective committees hereto duly authorized, have executed these presents, and the said commis-

sioners have hereunto set their seals, and the said companies have caused their corporate seals to be hereunto affixed, the day and year first above written.

(Signed,)

VERMONT AND MASSACHUSETTS R. R. CO.,

By their Committee, DANIEL S. ROBINSON, *Pres't*,

OTIS T. RUGGLES, *Sup't*.

FITCHBURG RAILROAD COMPANY,

By their Committee, WM. B. STEARNS, *Pres't*,

J. B. BRIGHAM,

M. J. WITT.

Witness to the signature of the Committee of the Vermont and Massachusetts and Fitchburg Railroads.

M. D. BENSON.

JAMES M. SHUTE,

ALVAH CROCKER,

*Commissioners.*

BOSTON, October 12, 1866.—The foregoing lease is approved in Council this day.

Attest:

OLIVER WARNER, *Secretary*.

The form of the foregoing contract is approved.

AUSTIN J. REED, *Attorney-General*.

[ C. ]

## CONTRACT.

[Acts of 1863, Chapter 214. Approved April 29, 1863.]

SECT. 6. The contract executed by the Troy and Boston Railroad Company on the eighteenth day of February eighteen hundred and sixty-three, by the Vermont and Massachusetts Railroad Company on the twentieth day of said February, and by the Fitchburg Railroad Company on the twenty-third day of said month, printed on pages eighty-eight to ninety-four inclusive, of the report of said commissioners, made on the twenty-eighth day of February aforesaid, and referred to in the message of the governor, dated the twelfth day of March, in the year eighteen hundred and sixty-three, is hereby approved, ratified and confirmed.

[Report of the Commissioners upon the Troy and Greenfield Railroad and Hoosac Tunnel, February 28, 1863, pages 88 to 94.]

\*88

## \* CONTRACT.

*Whereas*, For many years great efforts have been made by the Troy and Greenfield Railroad Company to finish their railroad and construct the Hoosac Tunnel, which, notwithstanding the aid granted to them by the Commonwealth of Massachusetts, they have found themselves wholly unable to accomplish, the means and credit of the Company having become exhausted, and further progress having stopped nearly two years ago, with no part of the road east of the tunnel opened for \*use, and the tunnel but little more than commenced; and

\*89

*Whereas*, It is of the utmost importance to the rest of the railroads forming the line from Boston *via* Fitchburg and Greenfield to Troy, that the said Troy and Greenfield Railroad and Hoosac Tunnel should be completed, by which they may become part of a short through line to the West; and

*Whereas*, The cost of constructing the said Hoosac Tunnel will be very large, and to a great extent uncertain in amount, and, at the least, wholly disproportionate to its revenue-earning value when considered as a piece of railroad of only its real length, while it will be of such vast benefit to the said whole line of railroads from Boston to Troy, that its construction is warranted as a commercial undertaking;



Nevertheless, the railroads so interested in and desirous of its construction, and to receive such large benefits therefrom, are not in a position to undertake it, or to render adequate aid to the Troy and Greenfield Railroad, to enable that Company to construct it, but in lieu thereof are willing to pay such just proportion of their earnings from business which may pass through said tunnel, or over said road, as shall be an equitable return for the benefits received.

*Now, therefore,* the Vermont and Massachusetts Railroad Company, and the Fitchburg Railroad Company, corporations created by the laws of Massachusetts, and the Troy and Boston Railroad Company, a corporation created by the laws of New York, in consideration that the Commonwealth of Massachusetts shall construct, or complete, or cause to be constructed or completed, the said Troy and Greenfield Railroad and Hoosac Tunnel, hereby severally, and not jointly, agree and bind themselves and their assigns to the Commonwealth of Massachusetts, to pay to the said Commonwealth certain sums of money, as follows:— \*90

Each of said companies hereby agrees to pay to said Commonwealth twenty (20) per cent., or one-fifth of all its gross earnings, upon such passenger and freight business as shall pass upon or over any part or the whole of the said Troy and Greenfield Railroad. For example: If either of said companies shall transport upon their railroad a ton of freight, and receive as their gross earnings for the same the sum of one dollar and fifty cents, and said freight shall pass over said Troy and Greenfield Railroad, or any part thereof, either before or after such transportation, then this said Company shall pay to said Commonwealth the sum of thirty (30) cents, and in the same proportion for earnings from passengers, or for a greater or less amount of earnings from passengers or freight which passes over any part of said Troy and Greenfield Railroad.

*Provided,* that if and whenever the payment of the said twenty (20) per cent., together with any similar or other payments which may have been actually received from any and all other sources, on account of earnings, shall make the net earnings upon the cost of the said Troy and Greenfield Railroad and Hoosac Tunnel, and the equipment thereof, more than six (6) per cent. in any year, or the gross earnings more than thirteen (13) per cent. for any year, then and in that case the said twenty per cent. may be reduced, for the time being, to such a less per cent. as, together with any similar or other payments which may have been actually received from any and all other sources on account of earnings, shall make the said net earnings six (6) per cent., or the gross earnings thirteen (13) per cent. \*on the cost of the said Troy and Greenfield Railroad and Hoosac Tunnel, and the equipments thereof. \*91

*Provided*, that whenever the earnings of the said Troy and Greenfield Railroad shall, without the payments therein provided for from the respective companies, amount for four (4) consecutive years to not less than six (6) per cent. net, or thirteen (13) per cent. gross, in each separate year, upon the cost of constructing the said Troy and Greenfield Railroad and Hoosac Tunnel, and the equipments thereof, then the payments herein provided for shall forever cease.

So far as this agreement is concerned, the cost of the said Troy and Greenfield Railroad and Hoosac Tunnel, and equipments thereof, shall be estimated to be, on the first day of January, A. D. 1863, the sum of nine hundred and sixty-eight thousand eight hundred and sixty-two dollars (\$968,862), to which shall be added the cost of their completion, as it shall be from time to time expended; and there shall also be added to the cost of construction the interest, at the rate of five (5) per cent., as it shall from time to time be paid on the bonds, which may be issued by the Commonwealth to raise money to pay for construction or interest; and upon such money as may not be raised by the issue of bonds, the interest at the same rate of five (5) per cent. shall be charged into the cost, on the first day of January and July in each year.

*Provided*, that no interest shall be charged into the cost of the works after eight years from the date hereof.

*Provided*, that all sums of money received as profits from operating or working a part of the said Troy and Greenfield Railroad, and for rents of the same before business shall commence to pass  
\*92 through the said \*tunnel, shall be deducted from the cost, as the same may from time to time be received.

And should it so happen after business shall have begun to pass through said tunnel, that the net earnings, over and above all expenses, together with the payments which may be received under the provisions of this contract, amount, in any one year, to less than five (5) per cent. net, or eleven (11) per cent. gross, upon the cost of the said Troy and Greenfield Railroad and Hoosac Tunnel, together with the equipments thereof, then and in any such case the deficit or amount which said net earnings and payments are below five (5) per cent. net, or eleven (11) per cent. gross, shall be added to the said cost, and the cost so increased shall be then reckoned, so far as this agreement is concerned, as the cost of the said Troy and Greenfield Railroad and Hoosac Tunnel, together with equipments thereof.

Settlements of accounts, under this provision, shall be for years ending December 31st, and for the first settlement, which may be for a fraction of a year, the interest shall be charged at the same *pro rata* rate for the said fraction of a year.

It is understood, that for such business as originates upon the Troy and Greenfield Railroad at or west of North Adams, and passes westward over any part of the Southern Vermont or Troy and Boston Railroads, and for such business as comes from the Troy and Boston or Southern Vermont Railroads and does not pass upon the Troy and Greenfield Railroad any further eastward than to North Adams, the Troy and Boston Railroad Company shall not, by reason of this contract, be required to make any contribution to the Commonwealth of Massachusetts.

\*It is hereby agreed, by the said several corporations, that they \*93 will pay and receive, as their respective proportions of the gross earnings on any freight or passengers which pass over the Troy and Greenfield Railroad, or any part thereof, and over any part or the whole of their several railroads, their *pro rata* proportion on each passenger or parcel of freight, which shall be computed and divided according to the distance it may have been carried upon the line between Boston and Troy; and from the gross earnings, so ascertained, the twenty (20) or other per cent. aforesaid is to come and be paid to the said Commonwealth, except as herein before provided in case of the Troy and Boston Railroad Company.

The payment of the said twenty (20) or other per cent. to commence when business begins to pass through the tunnel, though the said tunnel, or road and equipments, may not have been fully completed.

Such payments to be made monthly, as soon as practicable after the close of each month, and in any event before the close of the next succeeding month from the one for which the payment is due; and the books of said companies, in which are kept the earnings accounts, to be subject to the inspection, at any time, of a proper officer of the Commonwealth.

It is hereby agreed that, in the event of the Troy and Greenfield Railroad Company, or any other party, redeeming the said Troy and Greenfield Railroad and Hoosac Tunnel, and equipments, from the claims of the Commonwealth, the Commonwealth may, or may not, at its election, transfer to the party which should redeem, all its rights under this instrument, or continue to hold the same for its own benefit.

And the said Troy and Boston Railroad Company\* agrees that, for \*94 the purposes of this contract, the entire distance from the state line of Massachusetts to the city of Troy shall be deemed and treated a part of its road, although a portion thereof is leased by it from another corporation.

In witness whereof, the parties have hereunto affixed their hands and seals. The said Fitchburg Railroad Company, this 23d day of



February, A. D. 1863, by their President, duly authorized therefor ; and the said Vermont and Massachusetts Railroad Company, this twentieth (20th) day of February, A. D. 1863, by their President, duly authorized therefor ; and the said Troy and Boston Railroad Company, this 18th day of February, A. D. 1863, by their President duly authorized therefor.

TROY & BOSTON R. R. COMPANY,  
By D. THOS. VAIL, *President*.

In presence of [SEAL.]  
D. W. MOSELY, as to signature  
D. THOS. VAIL, *President*.

THE FITCHBURG RAILROAD COMPANY,  
By JNO. J. SWIFT, *President*.

Witness the signature of [SEAL.]  
JOHN J. SWIFT, *President*,  
A. CHAPMAN.

VERMONT & MASSACHUSETTS R. R. CO.,  
By ROBERT HALE, *President*.

B. D. LOCKE, witness to signature of [SEAL.]  
ROBERT HALE, *President*.

[Approved, ratified and confirmed by Act of the legislature, passed  
April 29, 1863.]

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*From the Special Message of His Excellency JOHN A. ANDREW,  
dated March 12, 1863.*

Among the successful efforts of the commission, the legislature will be gratified to notice that of securing an agreement, in writing, from the Fitchburg Railroad, the Vermont and Massachusetts Railroad and the Troy and Boston Railroad Companies, for the contribution, by each of those companies, to the Commonwealth, in consideration that it shall construct and complete the Troy and Greenfield Railroad and Hoosac Tunnel, of twenty per cent. or one-fifth of their gross earnings, respectively, upon the passenger and freight business coming upon their roads from any part of the Troy and Greenfield Railroad. This agreement, however, provides for its own modification or annulment when the earnings of the Troy and Greenfield Railroad shall have reached a point indicative of established and permanent success ; the particular tests of that success being predetermined in the agreement.



## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Four.

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### AN ACT

To provide for the organization of a Line of Railroad westwardly from Boston through the Hoosac Tunnel, in pursuance of existing Laws and Contracts.

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:*

1    SECT. 1. The governor, with the advice and  
2 consent of the council, shall, upon the passage of  
3 this act, appoint five trustees, citizens of this Com-  
4 monwealth, who, with such associate trustees as  
5 may be chosen as hereinafter provided and their  
6 successors, shall be a body corporate, by the name  
7 of the TRUSTEES OF THE BOSTON, HOOSAC TUN-  
8 NEL AND WESTERN RAILROAD, and by such name  
9 may sue and be sued, may have a common seal,  
10 may acquire by lease, purchase or otherwise, and  
11 may sell, convey and transfer any real or personal  
12 property necessary or desirable to carry out the  
13 purposes of this act, and shall have al the powers

14 and privileges, and be subject to the duties, liabilities and restrictions set forth in the general laws relating to railroads, and any amendments which may be made thereto, so far as the same may be applicable and not inconsistent with the provisions of this act.

20 One of said trustees shall be appointed to hold his office until five years, one until four years, one until three years, one until two years and one until one year from the second Thursday of January in the year of our Lord eighteen hundred and seventy-five; and that no vacancy may occur from the expiration of said terms of office, a trustee shall be appointed on or after the second Thursday in January in the year of our Lord eighteen hundred and seventy-six, and annually thereafter on or after the second Thursday of January in each year, to hold his office for the term of five years from the expiration of the term of service of the trustee in whose place he shall have been appointed. Any trustee may resign his office, and upon the occurrence of a vacancy before the expiration of a term, a trustee shall be appointed for the remainder of such term.

38 Before entering upon their duties the trustees shall be sworn to the faithful performance of the same.

41 The trustees shall organize by the election of a president, clerk and such other officers as shall be necessary, and shall adopt by-laws in accordance with which their meetings shall be held and their corporate powers exercised.

46 The trustees shall make to the legislature an annual report of their doings; and to the board of

48 railroad commissioners, all such reports and re-  
49 turns as from time to time shall be required by law  
50 of railroad corporations.

51 They shall severally receive in full compensa-  
52 tion for their services as trustees, such sum as the  
53 governor and council may prescribe for each day's  
54 service in the duties of their office, and payment  
55 for such reasonable expenses as they shall have  
56 incurred therein, and the president shall receive  
57 such further compensation as his associates may  
58 deem just and reasonable. Such compensation  
59 shall, with other expenses of the corporation, be  
60 paid out of the trust estate hereinafter provided to  
61 be held by the trustees.

1     SECT. 2. The trustees, upon their organization,  
2 as aforesaid, shall be, and be deemed to be, vested  
3 in trust, with all rights, franchises, interests, claims,  
4 equities, property and estate, which the Common-  
5 wealth has, is entitled to, or can claim, or elect to  
6 have or claim, in and to the Troy and Greenfield  
7 Railroad and Hoosac Tunnel and the Southern  
8 Vermont Railroad, and in and to all franchises,  
9 rights, contracts, leases and agreements in any  
10 manner appertaining or relating thereto or arising  
11 therefrom, and shall thereafter in trust hold, con-  
12 trol, exercise, manage, and operate the same,  
13 together with any and all other personal or real  
14 estate, rights, interests or properties and fran-  
15 chises, of which they may become possessed, or to  
17 which they may become entitled in pursuance of  
18 this act; with power and authority to exercise,  
19 enjoy, enforce, compromise, manage and operate

20 the same or any thereof, in such manner consist-  
21 ently with this act, as they in their discretion shall  
22 deem proper, but for the sole use, benefit and  
23 behoof of the Commonwealth, and of all such other  
24 persons or parties, as may, in pursuance of this  
25 act, be or become interested in and beneficiaries of  
26 the trust hereby provided, and according to the  
27 proportional interests therein of the Common-  
28 wealth and of such other persons or parties: *pro-*  
29 *vided, however,* that until other railroad properties  
30 shall be acquired for said trust by admission to an  
31 equitable and ratable participation therein, as  
32 hereinafter provided for, or in such other manner  
33 as is hereinafter provided for, the Commonwealth  
34 shall be and remain the sole beneficiary of said  
35 trust.

1     SECT. 3. In order that a continuous line may  
2 be established, and brought into use at the earliest  
3 practicable time, and that all questions affecting  
4 the rights or relations of the Commonwealth and  
5 other parties under existing contracts may be prop-  
6 erly adjusted or disposed of, the trustees shall  
7 proceed to negotiate with the owners of the Troy  
8 and Boston Railroad, the Vermont and Massachu-  
9 setts Railroad, the Fitchburg Railroad, and other  
10 parties, if any, having a right to control the pos-  
11 session of either of said roads, and of the roads  
12 herein before provided to be vested in the trustees,  
13 for the merging of their respective roads and  
14 properties in the trust by proper conveyances,  
15 transfers, or agreements, whereby such roads and  
16 properties, and the Troy and Greenfield Railroad



17 and Hoosac Tunnel and Southern Vermont Rail-  
18 road will be brought into a common ownership and  
19 management ; and, in furtherance of such purpose,  
20 may adjust, agree upon, consummate and perfect  
21 any such conveyances, transfers and agreements ;  
22 and for such purpose they are authorized and em-  
23 powered to make or cause to be made a just and  
24 relative valuation of the properties proposed to be  
25 merged into a common ownership and manage-  
26 ment, on the basis of an equitable equation of their  
27 respective traffic capacities; such equated value  
28 to be made upon, and to be restricted to, the road-  
29 ways, sidings and real estate necessary for the  
30 joint business, and having regard to curvature and  
31 gradients, and also to the expense of maintenance  
32 and operation. And in case it shall occur that the  
33 owners of either of said railroads have rolling-  
34 stock, equipment, supplies, terminal facilities, or  
35 other properties excluded from the equated value to  
36 be made as aforesaid, but which, in the opinion of  
37 the trustees would be beneficial to the trust, the  
38 trustees may acquire the same by agreement with  
39 any such party, or by an agreed on appraisal, the  
40 compensation therefor to be paid, either by the  
41 bonds or other evidences of indebtedness of the  
42 trustees, or in such other manner as may be agreed  
43 on by the parties and the trustees.

44 Upon such acquisition or merging of one or  
45 more of said roads and properties into the trust  
46 estate, or upon the acquisition of interests in either  
47 thereof, by the trustees as hereinafter provided for,  
48 the trustees shall proceed to define and declare the  
49 interests of the Commonwealth, and of all such

50 persons or parties from whom properties may have  
51 been acquired, in the trust estate, as follows :—

52 They shall make, or cause to be made, a full and  
53 complete schedule of the properties then belonging  
54 to the trust estate, with such money valuation  
55 thereof, considered as parts of the continuous line  
56 of railroad from Boston, in successful operation  
57 (whether such continuous line shall at such time be  
58 or not be perfected), as shall in their judgment be  
59 deemed fair : *provided, however*, that such valua-  
60 tion shall not be made to exceed, on a mileage  
61 basis, the sum of one hundred and fifty  
62 thousand dollars per mile ; and such valuation,  
63 until changed as hereinafter provided, shall  
64 be and remain the basis upon which the pro-  
65 portional interests of the Commonwealth and  
66 such other persons or parties shall be so de-  
67 fined and declared ; and thereupon they shall issue  
68 and deliver to the treasurer and receiver-general  
69 of the Commonwealth, and also to the persons or  
70 parties theretofore owning any of the aforesaid or  
71 other properties merged in or acquired by the trust  
72 in a common ownership, trust certificates, in sums  
73 of one hundred dollars each, or any multiple  
74 thereof, to an amount which shall be, and be equal  
75 to, the just proportion of the interests of the Com-  
76 monwealth, and of such other persons or parties  
77 respectively in the trust estate, on the basis of said  
78 valuation, so made or caused to be made by the  
79 trustees as aforesaid, the total amount of said  
80 certificates being made the same as the amount of  
81 said valuation.

82 Whenever, after the aforesaid issue of trust cer-  
83 tificates shall have been made, it may become

84 necessary for the trustees to make further and ad-  
85 ditional issues of certificates in compensation for  
86 such, or any, of the aforesaid properties as may  
87 not theretofore have been merged in the trust, the  
88 aforesaid valuation and basis of proportional inter-  
89 ests of certificate holders shall be and be deemed  
90 to be increased by the amount of such further  
91 additional certificates; and such valuation and  
92 basis shall in like manner be and be deemed to be  
93 further increased by the amount of any and all  
94 further and additional certificates which may  
95 thereafter be issued by the trustees, pursuant to  
96 authority hereinafter specifically expressed.

1     SECT. 4. All trust certificates shall be prepared  
2 and executed by such person or persons as the  
3 trustees shall in that behalf authorize; and shall  
4 bear the impression of their corporate seal, and shall  
5 be, and be taken to be, the only evidence of an in-  
6 terest, of the owner thereof or his legal represent-  
7 atives, of, in or to the property held by the trus-  
8 tees and belonging to the trust and the proceeds  
9 thereof, which interest shall, in said certificates, be  
10 declared to be such proportion of such trust prop-  
11 erty and of the proceeds and benefits thereof, as  
12 the sum expressed in the certificate shall bear to the  
13 total amount of all certificates which the trustees  
14 shall have issued or may issue in pursuance of  
15 this act.

16 All such certificates shall be of like form and  
17 effect and shall confer upon owners respectively  
18 equal and similar privileges, rights and benefits,  
19 except as varied or regulated by the amounts  
20 expressed therein.



21 The trustees shall prescribe such rules and regu-  
22 lations for the registry, transfer or exchange of  
23 trust certificates, as they shall deem most condu-  
24 cive to the safety and convenience of the trust,  
25 and all trust certificates shall be issued and received  
26 subject to such rules and regulations.

1     SECT. 5. In case the trustees shall be unable to  
2 acquire for the trust, on the basis herein before pro-  
3 vided for, either or any of the aforesaid railroad  
4 properties, whereby the purpose of this act may  
5 be delayed or defeated, or the public interests be  
6 imperilled, they may make such alternative ar-  
7 rangements by lease, contract, or otherwise, as in  
8 their discretion they may deem for the interests of  
9 the trust, and all persons and corporations with  
10 whom the trustees may make such agreements,  
11 contracts, mergers or arrangements as aforesaid  
12 are hereby authorized to make and conclude the  
13 same; and in case the trustees shall deem the acqui-  
14 sition of other than the aforesaid properties, or in-  
15 terests therein, essential or highly beneficial to the  
16 formation and business of said continuous line, and  
17 the successful operation and prosperity thereof,  
18 they are authorized and empowered in any such  
19 case to negotiate for and purchase the same  
20 or interests therein, and to issue in payment there-  
21 for, such amounts in trust certificates as shall be  
22 agreed upon between the trustees and the sellers  
23 of the same, and in furtherance of such purpose  
24 they are hereby authorized to receive, hold and  
25 exercise all rights, as owners, of such certificates  
26 of stock in any such railroad company as they  
27 may buy in pursuance hereof.



1     SECT. 6. The trustees may from time to time  
2 extend, relocate or change any portions of any  
3 railroad held by them in trust, proceeding therein  
4 in the manner provided by law for the taking of  
5 land by railroad corporations, and whenever the  
6 business of the corporation in their opinion shall  
7 require or justify increased facilities, rolling stock,  
8 double track, sidings or other improvements or  
9 properties appurtenant to railroads, the trustees  
10 may proceed to procure or make the same and  
11 provide the means of payment therefor by the  
12 bonds or other evidences of indebtedness of the  
13 corporation, secured, when necessary, by a lien  
14 upon the trust estate to such extent as may be  
15 required, but not exceeding at any time in the  
16 aggregate seventy-five per centum of the par value  
17 of all trust certificates issued, and may sell or hy-  
18 pothecate any of such bonds or evidences of in-  
19 debtedness as they shall deem expedient; and  
20 whenever it shall become necessary to redeem or  
21 pay such indebtedness, in case other provision  
22 cannot be made therefor, the trustees may issue  
23 and dispose of such an amount of trust certificates  
24 as may be requisite to make such redemptions or  
25 payments.

1     SECT. 7. The trustees shall manage and con-  
2 duct the financial affairs of the trust, so far as  
3 practicable, with such regard to the interests of  
4 the owners of trust certificates that semi-annual  
5 dividends may be paid them on their trust certifi-  
6 cates from and out of net earnings, after reserving  
7 or applying such sums only as may be properly  
8 chargeable for maintenance, repairs and deteriora-

9 tion of trust property : *provided*, that there shall  
10 be in possession of the trustees on any such divi-  
11 dend day money or means properly applicable  
12 thereto, sufficient to pay not less than two and  
13 one-half per cent. upon the total amount of certifi-  
14 cates then outstanding.

1     SECT. 8. The trustees shall be liable in their  
2 corporate capacity only ; and not personally, for  
3 debts, contracts and obligations contracted or in-  
4 curred by them, and for heretofore existing debts,  
5 contracts and obligations relating to the trust  
6 estate, and which may be assumed by the trus-  
7 tees ; and shall be so liable for torts, in the same  
8 manner as railroad corporations.

9     The trustees shall have no power in any way or  
10 manner to pledge or use the faith or credit of the  
11 Commonwealth, or to create any claim or demand  
12 upon it. Nor shall any obligation of, or claim or  
13 demand against the trustees be deemed or taken to  
14 be, or held to be an obligation of or demand or  
15 claim against the Commonwealth, and no owner  
16 or holder of trust certificates shall be in any man-  
17 ner held liable for the debts or obligations of the  
18 corporation, or for any action of the trustees.

19     The trustees shall not issue trust certificates  
20 which shall in any manner exceed the total amounts  
21 provided for in this act.

22     The trust property shall be, and be held liable  
23 to attachment and levy in suits against the cor-  
24 poration, in the same manner and to the same ex-  
25 tent as the property of railroad corporations, and  
26 suits may be commenced and prosecuted in the  
27 courts against the corporation, and indictment

28 found against it, in the same manner as against  
29 railroad corporations.

1     SECT. 9. In the management and operation of  
2 such railroads as shall come under the control of  
3 the trustees, other railroads connecting therewith  
4 directly or over intervening railroads, and offering  
5 reciprocal benefits, shall be entitled to running  
6 connections and facilities, and no unequal discrim-  
7 inations in fares, freight or facilities, in favor of or  
8 against such roads, or in favor of or against differ-  
9 ent persons or places shall be made; and in case  
10 of disagreement relating thereto, the same shall be  
11 determined by the board of railroad commissioners  
12 of the Commonwealth upon application of either  
13 party, or by arbitrators to be named in such  
14 manner as the parties may agree: *provided, how-*  
15 *ever,* that the terms which may be so awarded to  
16 any such connecting railroad shall not be more  
17 favorable than those upon which the Vermont  
18 and Massachusetts, the Fitchburg, and Troy  
19 and Boston Railroad companies, or either of  
20 them, may have connection.

1     SECT. 10. All moneys provided by the Com-  
2 monwealth for the completion of the Troy and  
3 Greenfield Railroad and Hoosac Tunnel, in pursu-  
4 ance of its contracts heretofore made, or otherwise,  
5 shall be held by the trustees, when received, as a  
6 separate fund, and shall be applied exclusively to  
7 the purposes for which they shall have been appro-  
8 priated, and shall be properly accounted for by the  
9 trustees to the Commonwealth.

1   SECT. 11. The books, papers, accounts and  
2 vouchers of the trustees shall be open at all reason-  
3 able times for the inspection of such agents, officers  
4 or committees of the Commonwealth as the legis-  
5 lature may in that behalf appoint, and also of the  
6 auditing committee of the owners of trust certifi-  
7 cates.

1   SECT. 12. The Commonwealth shall hold and  
2 retain whatever trust certificates it may receive  
3 as the equivalent for its rights, claims, demands  
4 and interests in the Troy and Greenfield Railroad  
5 and Hoosac Tunnel and Southern Vermont Rail-  
6 road hereby transferred in trust, together with all  
7 proceeds it may receive therefrom, to satisfy and  
8 liquidate the claims, if any, which shall be made,  
9 perfected and sustained, by the Troy and Green-  
10 field Railroad Company, or any other party, under  
11 the right of redemption, reserved or granted by  
12 existing law; so that, in no event, shall the trus-  
13 tees or the owners of trust certificates suffer any  
14 loss, harm or damage, by reason of any such pos-  
15 sible redemption, and when, and not until, the  
16 the claims or rights arising under such right of  
17 redemption shall be satisfied and released, or shall  
18 have expired, the Commonwealth shall proceed to  
19 sell and dispose of at public sale in the city of  
20 Boston, in each successive year thereafter, one-  
21 tenth part of any and all trust certificates belong-  
22 ing to it, unless otherwise directed by the legisla-  
23 ture.

1   SECT. 13. Annual meetings of the certificate  
2 holders shall be held in the city of Boston, on the



3 first Thursday of January in each year, and spe-  
4 cial meetings may be called by the trustees in  
5 their discretion. At each such annual meeting the  
6 owners (other than the Commonwealth) of trust  
7 certificates, may elect by a majority in interest of  
8 the certificate owners present or represented, a  
9 number of persons equal to the number of the rail-  
10 road companies whose roads and properties shall  
11 then have been merged in the trust estate, to be  
12 associate trustees, with the trustees appointed by  
13 the governor and council as herein before set forth:  
14 *provided, however,* that the number of such asso-  
15 ciate trustees so to be chosen by said owners of  
16 trust certificates, shall not at any time exceed four.

17 Such associate trustees shall hold their offices for  
18 one year from their election, and until others shall  
19 be chosen and qualified in their stead. Before  
20 entering upon their duties they shall be sworn to  
21 the faithful performance thereof. They shall have  
22 the same duties, powers and compensation as the  
23 trustees appointed by the governor and council.

1 SECT. 14. At any annual or special meeting of  
2 the owners of trust certificates at which two-thirds  
3 in interest thereof, except the Commonwealth,  
4 shall be present and voting in person or by proxy,  
5 it shall be competent for such meeting, by a vote  
6 of not less than three-fourths in interest of the  
7 meeting, exclusive of the interest of the Common-  
8 wealth, to propose to the legislature specific alter-  
9 ations or modifications of this act. And in case  
10 any such alterations or modifications shall be  
11 enacted by the legislature at its then session, or  
12 if the legislature is not in session, then by the

13 legislature next succeeding the meeting at which  
14 such alterations or modifications may so be pro-  
15 posed, they shall be binding upon the trustees and  
16 upon all persons or parties interested in the trust,  
17 the same as if originally incorporated herein.

18 And any act of the legislature relating to the  
19 trust, if accepted in like manner by any annual or  
20 special meeting of the owners of trust certificates,  
21 shall in like manner be binding upon all parties in  
22 interest: *provided, however*, that no alteration, mod-  
23 ification, or act of the legislature, amendatory of  
24 or in addition to this act, shall impose upon any  
25 owner of trust certificates any personal liability  
26 whatever.

1 SECT. 15. This act shall take effect upon its  
2 passage.

## Commonwealth of Massachusetts.

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### MINORITY REPORT.

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The undersigned feels compelled to dissent from the conclusions and bill presented by the majority of the Committee.

On the eve of the completion of the Tunnel, at an expense of more than twelve millions of dollars, when the great benefits expected to be derived therefrom are about to be realized, he cannot believe that without any knowledge of its value derived from actual experience, the Commonwealth is prepared to merge its five miles of railroad, which have cost so much, in a through line, and receive as payment therefor simply the same interest in the line as the owner of any other five miles of equal traffic capacity, costing but a trifle in comparison; nor, above all, that the Commonwealth is ready to place this gateway to its Western commerce in the keeping of a corporation beyond the control of the legislature.

At the same time he admits that measures should at once be taken to form a through line of railroad from Boston to the West in order that the full benefit from the Tunnel may be obtained.

The accompanying Bill is therefore submitted, which,

1st. Places the interests of the Commonwealth in the Tunnel and connecting railroad in the hands of trustees, and makes them a corporation to furnish the motive power to transport, without discrimination, the cars of all connecting railroads from one part of its road to another, at established rates, for the benefit of the State.

2d. Gives authority to the railroads of the Tunnel line to

consolidate with each other, and with railroads to Lake Ontario, thus opening through communication from Boston to the West.

3d. Adopting the excellent plan of the railroad committee of 1873, furnishes a cheap method by which the State can, in the future, obtain for its own benefit the consolidated line.

ANDREW J. BAILEY.



## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Four.

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### AN ACT

To incorporate the Boston and Ontario Railroad Company, the Trustees of the Hoosac Tunnel Railroad, and for other purposes.

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:*

1    SECT. 1. The governor, with the advice and  
2    consent of the council, shall, as soon after the pas-  
3    sage of this act as may be convenient, appoint five  
4    trustees, citizens of this Commonwealth, who shall,  
5    upon their appointment, be and be deemed to be  
6    vested in trust with all the property and interest  
7    of the Commonwealth in the Southern Vermont  
8    Railroad, the Troy and Greenfield Railroad and  
9    the Hoosac Tunnel, if it shall then be completed  
10   and surrendered by the contractors, and if not,  
11   then upon its completion and surrender, which  
12   said last named railroad and tunnel shall there-  
13   after be known as the Hoosac Tunnel Railroad,  
14   and the same shall be held in trust for the purposes

15 hereinafter named. One of said trustees shall  
16 hold his office for five years, one for four years,  
17 one for three years, one for two years, and one for  
18 one year, from the first day of May, eighteen hun-  
19 dred and seventy-four. Before the first day of  
20 May in each year, one such trustee shall be ap-  
21 pointed for the term of five years; upon the occur-  
22 rence of a vacancy before the expiration of a term,  
23 an appointment shall be made for the remainder of  
24 such term.

1     SECT. 2. Said trustees are hereby created a  
2 corporation under the name of the Trustees of the  
3 Hoosac Tunnel Railroad, and shall have all the  
4 powers and privileges, and be subject to the  
5 duties, restrictions and liabilities set forth in the  
6 general laws relating to railroads, so far as the  
7 same may be applicable and not inconsistent with  
8 the provisions of this act.

1     SECT. 3. Before entering upon their duties,  
2 said trustees shall be sworn to the faithful per-  
3 formance of the same. They shall organize by the  
4 election of a president, treasurer and clerk, and  
5 fix their compensations, and they shall prepare  
6 by-laws in accordance with which their meetings  
7 shall be held.

1     SECT. 4. Said trustees shall have sole charge,  
2 direction and control, subject to the provisions of  
3 this act, of said Hoosac Tunnel Railroad. They  
4 shall appoint such officers and agents as they may  
5 required for the operation of the same, define  
6 their duties and fix their compensations. They

7 shall make arrangements with connecting railroad  
8 corporations for the transportation of their cars,  
9 with their passengers and freight, on and over  
10 said Hoosac Tunnel Railroad, and establish rates  
11 therefor, and to this end may modify, adjust or  
12 annul any contracts or agreements concerning the  
13 transportation of passengers and freight over the  
14 tunnel line of railroads, and they may do all other  
15 things, not inconsistent with the provisions of this  
16 act and the general laws in relation to railroads,  
17 which they may deem necessary for the efficient  
18 and economical operation of said Hoosac Tunnel  
19 Railroad: *provided, however,* that in the manage-  
20 ment and operation of said railroad, other rail-  
21 roads connecting therewith, directly or over inter-  
22 vening railroads, and offering reciprocal benefits to  
23 other railroads connecting with said Hoosac Tunnel  
24 Railroad, shall be entitled to running connections  
25 and facilities, and no unequal discriminations in  
26 rates, freight or facilities, in favor of or against such  
27 roads, or in favor of or against different persons  
28 or places shall be made; and in case of disagree-  
29 ment relating thereto, the same shall be deter-  
30 mined by the board of railroad commissioners of  
31 the Commonwealth upon application of either  
32 party, or by arbitrators to be named in such  
33 manner as they may agree: *provided, however,*  
34 that the terms which may be so awarded to any  
35 such connecting railroad shall not be more favor-  
36 able than those upon which the Vermont and  
37 Massachusetts, the Fitchburg, and Troy and  
38 Boston Railroad companies, or either of them,  
39 may have connection.

1     SECT. 5. Said trustees shall hold in trust all  
2 moneys received from the operating of said rail-  
3 road, and all moneys which may be appropriated  
4 by the Commonwealth for its completion, exten-  
5 sion, improvement and equipment, and shall faith-  
6 fully apply the same. They shall annually pay  
7 into the treasury of the Commonwealth the net  
8 income received from said Hoosac Tunnel Railroad  
9 after the payment of the expenses; and the same  
10 shall be set apart, under the direction of the gov-  
11 ernor and council, and applied in such manner and  
12 at such times as they shall direct to either or all  
13 of the following purposes: the extinction of any  
14 indebtedness, or payment of interest thereon,  
15 which the Commonwealth may at any time incur  
16 to carry out the purposes of this act, or any act in  
17 addition to or amendment thereof, and the extinc-  
19 tion of the indebtedness, or payment of interest  
19 thereon, which has been or may be incurred in the  
20 construction of the Hoosac Tunnel.

1     SECT. 6. Said trustees shall make a semi-  
2 annual report to the governor and council of their  
3 doings during the six months next preceding, and  
4 of their receipts and expenditures, and shall make  
5 an annual report to the board of railroad commis-  
6 sioners in the manner and form and at the time  
7 prescribed for railroad corporations.

1     SECT. 7. Said trustees shall receive such sums  
2 in full compensation for their services as trustees  
3 as the governor and council may determine, which  
4 sums shall be charged to operating expenses, and  
5 no trustee shall be elected or appointed to any



6 office of profit in their employ, except that of  
7 president.

1     SECT. 8. Said trustees are hereby authorized  
2 to re-locate, where they deem necessary, the tracks  
3 of said Troy and Greenfield Railroad, taking land  
4 therefor in the method prescribed by law for the  
5 taking of land by railroad corporations, and to  
6 complete, extend and improve the construction  
7 and equipment of said railroad and tunnel, and to  
8 prepare the same in all respects for the reception  
9 of the traffic of a through line: *provided, however,*  
10 that they shall not purchase or procure any cars  
11 for the transportation of passengers or freight; nor  
12 shall they make any contracts for any such trans-  
13 portation except as provided in section four of this  
14 act.

1     SECT. 9. In order that a through line may be  
2 established and brought into use at the earliest  
3 practicable time, the said trustees are hereby  
4 authorized to convey to the Fitchburg Railroad  
5 Company, on such terms as they may agree upon,  
6 the property and interests of the Commonwealth  
7 in the Southern Vermont Railroad, and, as the  
8 agents of the Commonwealth, to assent to the  
9 transfer of the lease of said Southern Vermont  
10 Railroad, now held by the Troy and Boston  
11 Railroad, to said Fitchburg Railroad Company;  
12 and the said Southern Vermont Railroad shall  
13 thereupon become a part of said Fitchburg Rail-  
14 road; and the Fitchburg Railroad Company is  
15 hereby authorized to consolidate its railroad inter-  
16 ests, so formed, with the railroad interests of the

17 Troy and Boston Railroad Company, and to form  
18 one railroad corporation, by the name of the Boston  
19 and Ontario Railroad Company, in the manner  
20 following: The said railroad companies, at meet-  
21 ings duly called to consider the question of con-  
22 solidation, may, by a vote of a majority in interest  
23 of the stockholders present and voting at such  
24 meetings, at any time after the passage of this  
25 act, agree to consolidate and unite the said rail-  
26 road companies with each other, subject to the  
27 provisions of this act, in the manner and upon  
28 the terms to be fixed by three commissioners  
29 to be appointed by the supreme judicial court,  
30 unless such manner and terms shall be mutually  
31 agreed upon by the said railroad companies; and  
32 such votes so passed by said railroad companies  
33 shall be effectual to consolidate and unite into one  
34 corporation all of the said interests in respect to  
35 which such votes shall have been passed; subject,  
36 however, to the provisions of this act.

37 If within three months from the passing of such  
38 votes the terms of such consolidation shall not have  
39 been mutually agreed upon, then either of said  
40 railroad companies may apply to the supreme  
41 judicial court for the appointment of three com-  
42 missioners, to fix the terms of such consolidation,  
43 subject, however, to the provisions of this act; and  
44 upon such application and due notice, the court  
45 shall appoint such commissioners, the award of  
46 whom, or a majority of whom, being made to and  
47 confirmed by said court, shall be final; and the  
48 court shall enter such orders or decrees as may be  
49 found needful to carry such award into effect.

50 Said consolidated corporation shall have all the

51 powers and privileges, and be subject to all the  
52 duties and liabilities set forth in all general laws  
53 that now are or may hereafter be in force relating  
54 to railroad corporations, so far as the same are not  
55 inconsistent with the provisions of this act.

1   SECT. 10. The capital stock of the consoli-  
2 dated corporation shall not exceed the aggregate  
3 appraised value of the three component roads, and  
4 such other roads as may be consolidated therewith  
5 or purchased thereby under the provisions of  
6 this act, to be appraised by three commissioners  
7 appointed by the supreme court, and to be con-  
8 firmed thereby, and such additional amounts as  
9 shall actually be hereafter expended by said cor-  
10 poration for equipment, tracks and terminal  
11 facilities.

1   SECT. 11. The said consolidated corporation  
2 may purchase, lease, or consolidate with the Ver-  
3 mont and Massachusetts Railroad and any rail-  
4 road or railroads chartered or built between the  
5 intersection of the Troy and Greenfield Railroad  
6 with the state line of Massachusetts and Lake  
7 Ontario, or Lewiston on the Niagara River, or on  
8 the route thereto, and may operate and maintain  
9 the same, and may from time to time within  
10 five years from the passage of this act take  
11 and hold such additional lands as it may deem  
12 necessary for the enlargement of its depot accom-  
13 modations, or for straightening its line, or for  
14 making any necessary alterations, improvements  
15 and additions, compensation therefor to be deter-  
16 mined by law.



1     SECT. 12. The officers respectively of the said  
2 railroad companies shall continue to exercise, in  
3 behalf of the consolidated corporation, all the  
4 rights and powers which they before exercised,  
5 till the consolidated corporation shall be organized;  
6 and after the organization of the corporation formed  
7 as aforesaid, each of the railroad companies com-  
8 posing the corporation shall continue, for the pur-  
9 pose of perfecting the said union, and doing all  
10 such acts and things, if any, as may be necessary  
11 therefor, and shall execute all such transfers,  
12 assignments and conveyances as the corporation,  
13 formed as aforesaid, may deem necessary or ex-  
14 pedit to vest in itself any property, estates, con-  
15 tracts, rights or claims, if any there be, which do  
16 not vest in it by virtue of this act; and this consoli-  
17 dated corporation, subject to the provisions of this  
18 act, shall have all the powers, privileges, rights,  
19 franchises, property, claims, demands and estates  
20 which at the time of such union may be held and  
21 enjoyed by each of the said railroad companies  
22 composing the consolidated corporation, and be  
23 subject to all the duties, restrictions, obligations,  
24 debts and liabilities to which, at the time of the  
25 consolidation, each may be subject to in severalty;  
26 and all suits at law or in equity, and all proceed-  
27 ings before any tribunal which may be pending, to  
28 which either of said railroad companies shall be a  
29 party, may be prosecuted and defended by the cor-  
30 poration hereby authorized in the same name, in  
31 like manner and with the same effect as might have  
32 been done had such union not been formed. All  
33 claims, contracts, rights and causes of action, of  
34 or against either of said railroad companies, at law



35 or in equity, may be enforced by suit or action, to  
36 be commenced or prosecuted by or against the  
37 corporation formed as aforesaid.

38 And the said railroad companies shall continue  
39 corporations for the purpose of prosecuting or  
40 defending any suit or proceeding at law or in  
41 equity, or otherwise, now pending, or which may  
42 hereafter be brought by or against either of them  
43 out of this Commonwealth.

1     SECT. 13. The Commonwealth, or any corpora-  
2 tion authorized by the Commonwealth, may at any  
3 time after six months' notice in writing of its  
4 intention so to do, take and possess, with power to  
5 dispose of, the road, franchise, property, rights  
6 and privileges of the said consolidated corporation.  
7 In case of such taking, but subsequent thereto,  
8 the stockholders of the corporation shall receive,  
9 as compensation in full for each and every share of  
10 its capital stock by them individually surrendered,  
11 such sum of money as may be awarded by three  
12 commissioners, who shall be appointed by the su-  
13 preme judicial court, on petition of any party in  
14 interest, and duly sworn to appraise the same ac-  
15 cording to its true value at the time of such  
16 taking. The award of the commissioners or a  
17 majority thereof shall be rendered to the supreme  
18 court within one year after their appointment,  
19 and shall not be for a sum less than the par value  
20 per share of such stock; nor, in case the true value  
21 of such stock at the time such intention to take is  
22 notified shall exceed the par value, shall said  
23 award be for an amount in excess of the sum of  
24 ten dollars per share over and above the highest

25 average market value of such stock at *bona fide*  
26 cash sales made during any consecutive month  
27 within one year immediately previous to the notice  
28 of such intention to take; and said award being  
29 confirmed by said court shall be final. Pending the  
30 publication of said award, and until the surrender  
31 of the capital stock of the corporation, or the expira-  
32 tion of two months after the tender by the Common-  
33 wealth, or corporation authorized to take, through  
34 a notice published in a newspaper in the city of  
35 Boston, of the sum fixed by said award as the value  
36 of such capital stock, the holders thereof shall be  
37 entitled to receive, upon the first days of each  
38 April and October, or upon the usual semi-annual  
39 dividend days of said corporation, an amount equal  
40 to the average semi-annual dividend paid by said  
41 corporation during the two years immediately pre-  
42 ceding such taking, and in the same proportion for  
43 any time less than six months, and for the payment  
44 of said award and amount the credit of the Com-  
45 monwealth shall be pledged.

1    SECT. 14.   This act shall take effect upon its  
2    passage.

No 20

## SENATE . . . . No. 173.

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### Commonwealth of Massachusetts.

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IN SENATE, April 3, 1874.

The undersigned, dissenting from the report of the majority of the "Committee on the Hoosac Tunnel Line of Railroads," and also from the report of Mr. Bailey of the Senate on the same committee, present the following Bill :—

It will be readily seen that this bill neither disregards existing contracts nor leases between the Commonwealth and railroad corporations, proposes neither purchase nor consolidation of any line of railroad with the Hoosac Tunnel and Troy and Greenfield Railroad, encumbers the State with no new obligations, gives no corporation any advantage over any other in connection with the Hoosac Tunnel, guards this property of the State from liability of waste or loss, secures to the entire people of the Commonwealth every advantage reasonably counted upon in the construction of the tunnel, provides a method by which its value can be accurately estimated as a medium of traffic between the East and the West, prevents the creation of any railroad monopoly, and opens this grand avenue of inland commerce and keeps it open on equal terms to every line in and out of the State, either east or west, whether of railroad and canal already operated, or that may hereafter be constructed, and is so guarded as to call for a frequent and rigid accountability to the governor and council.

We deny that any existing contract between the State and railroad corporations is of such a character as to permit any corporation to dominate in the disposition, or control in any way the management of this property of the State. We do not think it is safe or wise to enter into any arrangement or consolidation, or take any risk of consolidation even by a permissive Act that may so result. While we do not accept the general principles of state management of railroads, in this especial case we see no safe way in which the State can delegate to any existing corporation or corporations the power to manage this property, and so accept the necessity existing for the State to retain and make a trial of managing it in some such way as we aim to secure. We feel assured that the obligation of this legislature to the people of the Commonwealth demands that the Hoosac Tunnel and other property therewith connected be not suffered to slip away from the absolute control, ownership and management of the Commonwealth, and that the people never ought nor will consent to let it pass out of their hands until the experiment of management, as contemplated by this bill, has been fairly, ably and thoroughly tried.

W. B. BROWN.

GEORGE HODGES.



## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Four.

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### AN ACT

To incorporate the State Board of Trustees of the  
Hoosac Tunnel Railroad.

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:*

1   SECT. 1. The governor, with the advice and  
2 consent of the council, shall, upon the passage of  
3 this act, appoint five trustees, citizens of this Com-  
4 monwealth, who shall, on or before the first day of  
5 July next, take the Troy and Greenfield Railroad,  
6 and the Hoosac Tunnel when it shall be completed  
7 or surrendered by the contractors, and all the  
8 property and interest of the Commonwealth in the  
9 Southern Vermont Railroad Company, and hold  
10 the same in trust for the purposes hereinafter  
11 named, which said railroad, tunnel, property and  
12 interest shall thereafter be known as the Hoosac  
13 Tunnel Railroad. One of the said trustees shall  
14 hold his office for five years, one for four years,  
15 one for three years, one for two years, and one for

16 one year from the first day of July next. Before  
17 the first day of July next in each year one such  
18 trustee shall be appointed for the term of five  
19 years; if a vacancy occurs before the expiration of  
20 a term, an appointment shall be made for the re-  
21 mainder of such term.

1     SECT. 2. Said trustees and their successors are  
2 hereby created a body corporate by the name of  
3 the "Trustees of the Hoosac Tunnel Railroad,"  
4 and shall have all the powers and privileges, and  
5 be subject to the duties, restrictions and liabil-  
6 ities set forth in the general laws relating to rail-  
7 roads so far as the same may be applicable and not  
8 inconsistent with the provisions of this act.

1     SECT. 3. Before entering upon their duties,  
2 said trustees shall be sworn to the faithful per-  
3 formance of the same. They shall organize by the  
4 election of a president, clerk and such other offi-  
5 cers as shall be necessary, neither of whom shall  
6 be a member of the board of trustees, and they  
7 shall prepare by-laws in accordance with which  
8 their meetings shall be held and their corporate  
9 powers exercised; at all meetings four trustees  
10 shall be a quorum.

1     SECT. 4. Said board of trustees shall have sole  
2 charge, direction and control, subject to the provis-  
3 ions of this act, of said Hoosac Tunnel Rail-  
4 road. They shall appoint a treasurer who shall  
5 give bonds for the faithful performance of his  
6 duties, in such amount and with such sureties as  
7 shall be satisfactory to the governor and council.  
8 They shall also appoint a general manager, when-

9 ever they deem such an officer necessary, one or  
10 more superintendents, and any other agents that  
11 may be required for the efficient and economical  
12 operation of said Hoosac Tunnel Railroad, and  
13 they shall define the duties and fix the compensa-  
14 tion of such officers and agents. They shall make  
15 contracts and arrangements with any railroad cor-  
16 poration connecting directly, or by means of an  
17 intervening railroad, for the passage or transport-  
18 ation of their trains or cars with their freight and  
19 passengers on and over said Hoosac Tunnel Rail-  
20 road, and they may do all other things not incon-  
21 sistent with the provisions of this act and the gen-  
22 eral laws in relation to railroads, which may be  
23 needful for the efficient and economical operation  
24 of said Hoosac Tunnel Railroad.

1     SECT. 5. Said board of trustees shall hold in  
2 trust all moneys received for earnings of said rail-  
3 road and tunnel, and all moneys which may be ap-  
4 propriated by the Commonwealth for the com-  
5 pletion or improvement of said Hoosac Tunnel  
6 Railroad, and for operating the same, and shall  
7 faithfully apply the same. They shall semi-annu-  
8 ally pay into the treasury of the Commonwealth  
9 the net income received from said Hoosac Tunnel  
10 Railroad after the payment of the expenses; and  
11 the same shall be set apart, under the direction of  
12 the governor and council, and applied in such man-  
13 ner and at such times as they shall direct to either  
14 or all of the following purposes: The extinction  
15 of any indebtedness or payment of interest thereon  
16 which the Commonwealth may at any time incur  
17 in carrying out the purposes of this act, or any

18 act in addition to or amendment thereof, and the  
19 extinction of the indebtedness or payment of inter-  
20 est thereon, which has been or may be incurred in  
21 the construction of the Hoosac Tunnel.

1     SECT. 6. Said board of trustees, in addition to  
2 the annual report required of railroad corporations,  
3 shall, on the last days of March and September,  
4 make a semi-annual report to the governor and  
5 council of their doings during the six months next  
6 preceding, and of their receipts and expenditures.

1     SECT. 7. Said trustees shall submit all con-  
2 tracts and arrangements proposed to be made with  
3 any railroad corporation respecting the passage or  
4 transportation of their cars, with or without pas-  
5 sengers and freight, to the governor and council  
6 for their ratification and approval; and any such  
7 contract shall be void unless so ratified and ap-  
8 proved within three months of its date; and said  
9 trustees, with the approval of the governor and  
10 council, may modify any existing contract with  
11 any railroad corporation relating to the use of said  
12 railroad or any part thereof.

1     SECT. 8. Said trustees shall receive such sum  
2 in full compensation for their services as trustees  
3 as the governor and council may prescribe for each  
4 day's actual service in the duties of their office,  
5 and payment for such reasonable expenses as they  
6 shall have incurred therein, which sums shall be  
7 charged to operating expenses. No trustee shall  
8 be appointed to any office in the employ of said



9 board of trustees; and no person in the employ of  
10 any railroad corporation, or owning stock in any  
11 railroad corporation, shall be eligible to the office  
12 of trustee, president, superintendent, general man-  
13 ager, treasurer or clerk.

1     SECT. 9. Said board of trustees are hereby  
2 authorized to relocate, where necessary, the tracks  
3 of said Troy and Greenfield Railroad, taking land  
4 therefor in the method prescribed by law in case  
5 of land taken for railroad purposes, and to com-  
6 plete, extend and improve the construction and  
7 equipment of said railroad and tunnel, and to  
8 prepare the same in all respects for local and  
9 through traffic: *provided, however*, that they shall  
10 not purchase nor procure any cars for the trans-  
11 portation of passengers or freight, or make any  
12 contracts for such transportation, except as pro-  
13 vided in sections four and seven of this act.

1     SECT. 10. In the management of said Hoosac  
2 Tunnel Railroad, and in all contracts and arrange-  
3 ments made in pursuance of any authority herein  
4 conferred by this act, there shall be no unequal dis-  
5 criminations in freights, fares or facilities in favor  
6 of or against different persons, places or contract-  
7 ing railroad corporations; and the corporation  
8 hereby created shall not make any contract  
9 whereby any other corporation may perform all  
10 the transportation upon and over said Hoosac  
11 Tunnel Railroad; and said corporation shall not  
12 lease said railroad, nor take a lease of the railroad  
13 of any other corporation.

1    SECT. 11. No act of the legislature hereafter  
2 passed shall apply to the corporation hereby  
3 created, or to the property in its possession, unless  
4 this corporation be specifically referred to in said  
5 act.

1    SECT. 12. This act shall take effect upon its  
2 passage.

## HOUSE . . . . No. 395.

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Commonwealth of Massachusetts.

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HOUSE OF REPRESENTATIVES, May 19, 1874.

The Committee on the Hoosac Tunnel and Troy & Greenfield Railroad, to whom was referred the petition of the Vermont & Massachusetts Railroad Company for compensation for buildings erected on the line of the Troy & Greenfield Railroad Company, and for other claims, have heard the petitioners, represented by their counsel, Hon. W. W. Warren. The Boston & Fitchburg Railroad Company have succeeded to the rights of the petitioners. Said claims are embraced in their schedules, marked "A," "B" and "C," to which reference is made.

In 1872 the passenger station at Shelburne Falls was destroyed by fire, and the engine-house at Hoosac Tunnel was blown down by a hurricane. Both of these structures were rebuilt by the Vermont & Massachusetts Railroad Company, lessees of the Troy & Greenfield Railroad. The said lessees also rebuilt a bank wall east of Zoar Station, which became necessary by reason of its original defective construction. These claims are embraced in the first, second and last items of Schedule A.

The Committee are of opinion the Commonwealth is bound, under the lease of the Troy & Greenfield Railroad, to restore these structures or to reimburse the petitioners for the cost of rebuilding. The other items in said schedule the Committee have disallowed.

The claims set out in Schedule B, in the opinion of the Committee, the Commonwealth is under no obligation to pay.

Whether it would be wise and prudent for the Commonwealth, under some circumstances, to buy and pay for the property described in this schedule the Committee has not thought it necessary to determine, being of opinion that the present unsettled purpose of the Commonwealth with reference to the disposition of the Hoosac Tunnel and the Troy & Greenfield Railroad renders it inexpedient at the present time to make any recommendation with reference to these matters.

Upon the matters embraced in Schedule C, the Committee report that, by evidence and observation, they were satisfied that very considerable repairs are now necessary to the road-bed and track of the Troy & Greenfield Railroad east of the Tunnel, in order to render it safe and convenient for travel, which, according to the terms of the lease, it is claimed by the petitioners the State is under obligation to make. Without deciding the legal construction of the law upon the question, the Committee recommend that the lessees be authorized to expend such sums, not exceeding the rent to accrue by their lease between April 1, 1874, and October 1, 1874, upon the repair of the road-bed and track of the Troy & Greenfield Railroad, east of the Tunnel, as they may see fit, and such sums so expended shall, upon satisfactory proof thereof furnished to the governor and council, be accepted so far as the same may be sufficient in payment of the rent so reserved.

The Committee append hereto the statement of the grounds upon which the petitioners base their claims.

The Committee recommend the adoption of the accompanying Resolves.

For the Committee,

BROWNELL GRANGER.



## Commonwealth of Massachusetts.

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In the Year One Thousand Eight Hundred and Seventy-Four.

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### RESOLVES

For the payment of certain Constructions and Repairs on  
the Troy and Greenfield Railroad.

*Resolved*, That the governor and council be and they hereby are authorized to pay to the Vermont and Massachusetts Railroad Company, their successors or assigns, such sums as may be shown by said railroad company to have been reasonably and properly expended by said company in the construction and rebuilding of a passenger station at Shelburne Falls, an engine-house at Hoosac Tunnel and a bank wall east of Zoar Station, not to exceed in all the sum of thirty-three hundred and seventy-eight dollars (\$3,378). And such sum, not to exceed thirty-three hundred and seventy-eight dollars, is hereby appropriated to be paid out of the treasury of the Commonwealth for the purpose aforesaid.

*Resolved, further*, That the Boston and Fitchburg Railroad Company be authorized to expend such sum, not to exceed in the aggregate the rent to accrue between April one, eighteen hundred and seventy-four, and October one, eighteen hundred and seventy-four, under the lease to them of the Troy and Greenfield Railroad, dated October eight, eighteen hundred and sixty-six, and that upon satisfactory proof thereof to the governor and council the same be accepted as payment *pro tanto* for the rent so reserved.

*Statements of Matters properly before the Committee on the Hoosac Tunnel and Troy & Greenfield Railroad, and in which the Fitchburg and Vermont & Massachusetts Railroads are immediately interested.*

Referred to the Committee,—

1. Such portions of the message of the Governor, etc.  
(Compare the message, pp. 37-40 ; also p. 48.)
2. Report of Mr. Philbrick.
3. Petition of Vermont and Massachusetts Railroad.
4. Report of the Joint Standing Committee on the Troy and Greenfield Railroad and Hoosac Tunnel of 1873.

There are three classes of claims which the Fitchburg Railroad, for itself and as the representative of the Vermont & Massachusetts Railroad, makes upon the Commonwealth.

*First.* For compensation for expenditures made by the corporations to replace property of the State destroyed. (Schedule A.)

*Second.* For a fair price for certain buildings and sidings, built by the corporations and necessary for the operation of the railway. These the State is not legally bound to buy ; but, unless it does buy them, will be obliged, when it comes into the possession of the railway, to supply itself with equivalent buildings and sidings at increased cost. Consequently, we claim that it is for the interest of the State to purchase these buildings and sidings at a fair valuation ; and if the State intends to purchase them, it should in fairness elect to do so at once, before the termination of the lease. (Schedule B.)

*Third.* For compensation for work to be done and new materials to be furnished for a substantial reconstruction of a considerable portion of the Troy and Greenfield track.

This claim requires explanation, and depends for its validity upon the decision which the legislature may reach in regard to the future of the Tunnel.

If the State shall elect to take immediate possession of the railway, and proceed *at once* in the work of reconstruction, which Mr. Philbrick declares to be necessary, and the need of which the inspection of the Committee has also demonstrated, then this claim may be abandoned.

But if, on the other hand, the State desires the Fitchburg Railroad to continue to operate the road through the coming summer and winter, and such portion of next year as may elapse prior to the completion of the Tunnel, then it will be necessary to make forthwith a portion of the expenditures for the reconstruction of the railway, which Mr. Philbrick describes in his report.

For a memorandum of the cost of these immediately necessary constructions, see Schedule C.

But these constructions are not within the scope of any duty or obligation imposed upon the corporation by its lease from the State.

On the contrary, they are made necessary by original bad construction, and in fact by a failure on the part of the State to perform its part of the covenants contained in that lease; and on the other hand, the benefit of the work, if done by the corporation, will enure almost entirely to the State, after the termination of the lease.

The failure of the State to perform its covenant is twofold.

The Commonwealth covenanted "to build said railroad in a substantial manner, corresponding with the average of well-built railroads in New England, and to put it in complete condition to operate." (See Lease dated October 8, 1866, printed with Report of Joint Special Committee on Tunnel Line of Railroad, Senate Doc. No. 112, p. 115.)

Pursuant to agreement, the Commonwealth proceeded to put the road into the agreed condition (as was supposed), and on December 30, 1867, the Vermont & Massachusetts commenced to operate the road.

But another part of the agreement (p. 16 of Senate Doc. No. 112) provided "that the Commonwealth should proceed

with all reasonable and practicable despatch in constructing the Hoosac Tunnel, and that in case of the suspension of work thereon, brought about by action of the legislature, or other competent authority, this agreement may be vacated at the option of either party, upon written notice given by either party thereto to the other."

If the road had been constructed in accordance with the agreement first stated, and the work were prosecuted in accordance with the second agreement above quoted, then there can be no question that, except in the event of a catastrophe like the freshet of 1869, the road would have required no considerable renewal of materials during the term of the lease.

By the terms of the Shanly contract, the work on the Tunnel was to have been completed March 1, 1874 (with a possible lee-way until September).

It now appears however that "the sleepers are very much decayed, especially on the eastern half, below Shelburne Falls, and the rails are all worn out, except for such short distances as it has been found absolutely necessary to replace them with new iron, for the sake of safety, *proving their wretched quality when new*; while the embankments, never finished at a liberal width or with suitable materials, have been continually slipping away since first built." (Philbrick's Report, p. 8.)

One fact which explains the decay of the sleepers is not stated by Mr. Philbrick, and has recently come to our knowledge. The sleepers were many of them of red oak, and had been left upon the ground some four years before they were put into the road-bed. Then they were decayed on the exposed surface, and were put into the road with the rotten side down, and were of course entirely insufficient to last during the term of the lease.

It further appears that by reason of the necessity of arching over the Tunnel, that will not be ready for use until some time in the summer of 1875. And this delay in completing the work is attributable either to the failure of the agents of the Commonwealth to seasonably discover the requirements of the Tunnel, or if these requirements were known, then to the neglect of the Commonwealth to provide for them.



And it follows that the work which must be done this summer is made necessary by the default of the State in these two respects,—first, original defective construction ; secondly, tardy completion of the work.

It may be suggested that when the Vermont & Massachusetts (for the two corporations) accepted the road pursuant to the terms of the lease, they bound themselves to keep it in repair, and took the risk of improper construction, waiving all right afterwards to object.

To this it would be a sufficient answer, that the defective construction was at the time concealed, and was not found out by the corporations until time revealed the rottenness of the sleepers and the poor quality of the rails.

A second and complete answer is to be found in the express provision of the lease, which excepts from the covenant of the lessees to keep the road in repair, "ordinary wear and tear, and all subsidence and damages arising from the defective and insufficient construction of the road, which shall be repaired by the Commonwealth."

The State recognized this obligation after the great freshet, and as it now admits the defective and insufficient construction of the ties and rails, it cannot properly refuse to make the repairs of them, as well as of the embankments.

The corporation wishes to do all it can to carry out the purposes of the State, and it is entirely willing to operate the road, provided it can do it with safety to itself and to the public ; but it considers the proposition unquestionable, that under the terms of the lease the State has assumed the risk of all loss and damage which may result from the defective construction, insufficient repair, and unsafe condition of the road.

The position, then, of the Fitchburg Railroad on this branch of its claims is simply this : the State may have the alternative, either to take into its own hands, by such form of enactment as the legislature deem wise, the Troy and Greenfield road, and finish it ; or it may, if it deems best, leave the road in the hands of the Fitchburg Railroad Company to be operated until the completion of the Tunnel.

But on this latter alternative, it will be absolutely necessary for the State to provide the corporation with the means for putting the railroad in a safe condition for operation.

This may be done by an appropriation sufficient to defray the expenditures in Schedule C.

But if nothing is done by the State to improve the present condition of the road and render it more safe, it is certainly the duty of the Fitchburg Railroad Company to carefully consider and decide whether it can, consistently with a due regard to human life and its own possible liability as a common carrier, continue to run the road any longer.

The Vermont & Massachusetts Railroad and the Fitchburg Railroad companies, have already lost in operating the road under the lease, \$200,000, exclusive of the amount paid to maintain the stages over the mountains; and we think that if the State desires the Fitchburg Railroad Company to continue to operate the road after the time when the Hoosac Tunnel should properly have been completed, the company ought not to be asked to pay any rent after that time.

In view of the situation of things, it needs no argument to prove that the matters embraced in this statement should be acted upon by the present legislature.

#### SCHEDULE A.

1872.

Sept. 30.	Amount expended in rebuilding passenger station at Shelburne Falls on Troy & Greenfield Railroad (the old station having been struck by lightning and burned to the ground July 4, 1872),	\$2,048 00	
Aug. 13.	<i>Credit.</i> By cash received of Tremont Insurance Company for insurance on said passenger station,	1,000 00	
		<hr/>	\$1,048 00
Sept. 30.	Amount expended in rebuilding engine-house at Hoosac Tunnel on Troy & Greenfield Railroad (the old engine-house having been destroyed by a hurricane),	.	1,947 69
	<i>Amount carried forward,</i>	.	<hr/> \$2,995 69

*Amount brought forward,* . . . \$2,995 69

1872.

July.	Amount paid Mr. Omsbee for carpenter's work, putting up office in freight depot, Shelburne Falls, . . . . .	44 20
	Trackman's labor on same, reported by roadmaster, . . . . .	17 00
Aug.	Amount paid Mr. Omsbee for carpenter's work, per August pay-roll, . . . .	50 00
Sept.	Amount paid Mr. Omsbee for carpenter's work, per September pay-roll, . . . .	23 00

1873.

Oct.	Rebuilding bank wall east of Zoar station, . . . . .	381 99
		<hr/>
		\$3,511 88
		<hr/>

#### SCHEDULE B.

House, hotel, and other buildings at Hoosac Tunnel, . . . . .	\$17,566 35
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Iron, &c., in sidings,—

28,037 lbs. at West Deerfield,	. 751 feet,	} 4,019 87
16,875 “ at Bardwell’s Ferry,	. 452 “	
32,443 “ at Shelburne Falls,	. 869 “	
11,648 “ at Crittenden’s,	. 312 “	
27,589 “ at Zoar,	. 739 “	
22,400 “ at Hoosac Tunnel,	. 600 “	
21,803 “ at Marble Quarry,	. 584 “	
		<hr/>
		\$21,586 22

#### SCHEDULE C.

New sleepers, . . . . .	\$25,000 00
Rails and grading, . . . . .	25,000 00
	<hr/>
	\$50,000 00





# LEASE

OF THE

Vermont & Massachusetts Railroad  
COMPANY,

TO THE

FITCHBURG RAILROAD COMPANY,

FOR

*Nine Hundred and Ninety-Nine Years,*

FROM JANUARY 1st, 1874.



FITCHBURG:

PRINTED AT THE REVEILLE STEAM PRINTING WORKS.

1874.









# LEASE.

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**This Indenture**, made this first day of January in the year of our Lord one thousand eight hundred and seventy-four, by and between The Vermont and Massachusetts Rail Road Company, a Corporation existing under and by virtue of the laws of the States of Massachusetts and Vermont, of the first part, and The Fitchburg Railroad Company, a Corporation existing under and by virtue of the laws of the State of Massachusetts, of the second part—*Witnesseth*—

*That the said Vermont and Massachusetts Railroad Compa-* <sup>Property  
leased.</sup>  
*ny doth hereby lease, demise, and let unto the said Fitchburg Railroad Company, its successors and assigns, its Railroad extending from the terminus of the Fitchburg Railroad in Fitchburg to Brattleboro in the state of Vermont, and from "Grouts Corner" in Montague to Greenfield, together with its branch from Deerfield to Turners Falls—and also all the lands on which said Railroad is, or shall be located within said terminal points ; or which are connected with the uses of said Vermont and Massachusetts Railroad Company and are its property, and all the rights, easements, franchises, and privileges appurtenant thereto—and all the turn-outs, branch-tracks, depot grounds, water rights, stations, super-structures, and fixtures connected therewith, or belonging thereto, or used therewith, and the lands on which the same are now situate or standing, so far as the same are the property of the said Vermont and Massachusetts Railroad Company, and whether included within its location or not—and generally all and singular the real estate, tenements, franchises, and appurtenances of the party of the first part, and all its*

Property  
assigned  
and made  
over.

cars, engines, and equipments of every nature and description. Also all the personal property of the party of the first part, however the same may be described, or wherever situate,—saving and excepting only that all its open contracts for the transaction of its business, its notes, accounts, bills receivable, cash, cash funds, all its interest in the sinking fund, and claims of whatever nature and description, outstanding in its favor or arising or hereafter to arise under any contract or contracts, and belonging to the party of the first part, on the first day of January in the year of our Lord one thousand eight hundred and seventy-four, are on that day to be and become the full and absolute property of the said Fitchburg Railroad Company, and the same are hereby conveyed to said last named corporation in consideration of these presents—

Contracts  
& encum-  
brances  
to which  
leased  
property  
is subject.

Excepting however and always provided, the foregoing demise is made subject to a lease from the Vermont and Massachusetts Railroad Company to the Rutland Railroad Company of that part of its road extending from “Grouts Corner” to Brattleboro, and to all the covenants, stipulations, and provisions therein contained; and also subject to all the terms and conditions of a contract by and between said Vermont and Massachusetts Railroad Company and the Cheshire Railroad Company for the joint use by the said two Companies of so much of the road of the Vermont and Massachusetts Railroad Company as extends from Fitchburg to Ashburnham Junction, and for other privileges, to which lease and contract reference may be had; and also subject to all other existing incumbrances, liens, and contracts (although not specifically mentioned) entered into, made, or suffered by the Vermont and Massachusetts Railroad Company. And the Fitchburg Railroad Company shall be entitled to receive the rent reserved under said lease and contract, now or hereafter to become due, and to the full benefit of all the covenants of the lessees in said lease and contract; and the Vermont and Massachusetts Railroad Company will execute all instruments which shall be reasonably necessary for that purpose.

To have and to hold the same to the said Fitchburg Rail-<sup>Term.</sup>  
road Company, its successors and assigns for the the term of  
nine hundred and ninety-nine years from and after the first  
day of January in the year of our Lord one thousand eight  
hundred and seventy-four.

And the said Vermont and Massachusetts Railroad Com-<sup>Covenant</sup>  
pany doth hereby covenant and agree with the said Fitchburg<sup>to confirm</sup>  
Railroad Company, that it will, at all times, upon reasonable<sup>and effectuate.</sup>  
request, execute any and all instruments that may be requisite  
or necessary to confirm, and to its full meaning and intent  
effectuate and establish the foregoing lease and assignment.

And the said Vermont and Massachusetts Railroad Compa-<sup>Covenant</sup>  
ny doth further covenant and agree, that it will upon the writ-<sup>to sell real</sup>  
ten request of the Fitchburg Railroad Company, sell and con-<sup>estate.</sup>  
vey to such person or persons as the said Fitchburg Railroad  
Company may appoint, such portions or parcels of the real estate  
held in fee by the Vermont and Massachusetts Railroad Com-  
pany, and outside of its location, as the said Fitchburg Railroad  
Company may designate, and upon such reasonable terms as  
the said Fitchburg Railroad Company may direct; but upon the  
express agreement however, by the Fitchburg Railroad Com-  
pany that all the proceeds thereof, or a sum equal thereto,  
shall be, or shall previously, from the funds of the Fitchburg  
Railroad Company, have been, applied to permanent and sub-  
stantial improvements, upon or connected with the road or  
real estate of the Vermont and Massachusetts Railroad Com-  
pany, and such as are not in the nature merely of renewals or  
repairs.

And the said Vermont and Massachusetts Railroad Compa-<sup>Covenant to</sup>  
ny doth further agree, that, during the continuance of this lease<sup>maintain or-</sup>  
and agreement, it will maintain its organization and existence<sup>ganization.</sup>  
as a body corporate, and to that end will comply with all  
the forms and requisites of the law; and that it will do and  
perform all such acts, at the request of the party of the second  
part, lawful and consistent with the rights of the party  
of the first part, and its public duty, as shall be proper and

necessary to the due preservation and protection of all the property, rights, franchises and interests herein demised or granted to the party of the second part, and to the improvement of its property and increase of the facilities of its business, to carry into effect the true intent and meaning of this agreement, and that in default thereof the same may be done by the party of the second part, so far as it can lawfully do the same, or by its agents, successors, and assigns, in the name and as the act of the party of the first part; and also that the party of the second part may use the name, franchise, and corporate power of the party of the first part in commencing and prosecuting any suit in law or equity, which may be necessary to enable the party of the second part to assert or maintain any right secured to it by this instrument, or to enforce payment of damages for injury thereto; and also that the party of the first part will not engage in any new enterprise, construct any new road, issue any additional stock, or incur any new debt or liability except in the issue of bonds or stock as herein provided for the purposes herein expressed, so long as this lease is valid and binding, except at the written request of the Fitchburg Railroad Company; and will not in any way interfere or act in the use or management of its road or its appurtenances, except it shall be authorized to do so by re-entry in case of default of the party of the second part as hereinafter provided.

That Lessee may use the name of the Lessor.

That Lessor will not engage in any new enterprise.

That Lessor will do all Corporate Acts for improving & straightening road.

And the said Vermont and Massachusetts Railroad Company doth agree to do all lawful corporate acts, upon the request of the said Fitchburg Railroad Company, that may be necessary for the improvement or straightening of said Railroad, its stations, or grounds; provided, always, that all the expenses incurred by the said party of the first part, under this, or the preceding clause shall be borne by the party of the second part.

Covenant for the issue of additional bonds.

And whereas it is probable that large expenditures may be necessary upon the line of the Vermont and Massachusetts Railroad to accommodate traffic, the said Vermont and Massachusetts Railroad Company doth further covenant and agree



that it will, at the written request of the Fitchburg Railroad Company, from time to time issue its additional unconvertible bonds, at a rate of interest either of six or seven per cent. at the option of the Fitchburg Railroad Company, to the extent of its right under its charter and legislative acts in that behalf, and any further legislative acts which may be hereafter passed; provided however said issue of additional bonds shall never exceed one million, five hundred thousand dollars, (except renewals of its bonds as hereinafter provided) to be delivered to and sold by said Fitchburg Railroad Company, but at not less than par, and upon the express agreement by the Fitchburg Railroad Company, that it will pay the principal and interest thereof as they may become due, and save the Vermont and Massachusetts Railroad Company harmless therefrom, and will, in the event that it places a mortgage or other lien upon its road, or upon its interest in the Vermont and Massachusetts Road, include and secure in said mortgage all said bonds outstanding and unpaid, and all bonds issued in renewal of the same as hereinafter provided—and upon the further agreement, that all the proceeds of said bonds, or a sum equal thereto, shall be or shall have previously, from the funds of the Fitchburg Railroad Company, been applied to the purchase of real estate for railroad purposes upon or immediately connected with the road of the Vermont and Massachusetts Railroad Company, and in its name, but for the occupation of the Fitchburg Railroad Company as lessee, or to permanent and substantial improvements, and such as are not in the nature of renewals or repairs, upon or connected with the road, road bed, bridges, track or real estate of the said Vermont and Massachusetts Railroad Company, or for the straightening or alteration of the line of the road of the Vermont and Massachusetts Railroad Company, or laying other tracks, or for excess in cost of steel over iron rails, or for any or all said purposes, but for no other purpose whatever.

Covenant  
for the issue  
of additional  
bonds.

Covenant  
to sell  
Brattleboro  
Branch.

And the Vermont and Massachusetts Railroad Company doth further covenant and agree with the Fitchburg Railroad Company, that it will, upon the written request of the Fitchburg Railroad Company, sell and convey to such person or persons or corporation as may be designated in such request (provided such sale can lawfully be made) that portion of the Vermont and Massachusetts Railroad, which lies between "Grout's Corner" and Brattleboro, Vermont, and known as the Brattleboro Branch, with all, or any part, of the real estate reasonably appertaining to that portion of the road, upon such reasonable terms as said Fitchburg Railroad Company may direct; and in case of a dispute between the parties to this lease as to the reasonableness of the said terms, the same shall be determined by referees chosen, one by each of said parties, and the third by the two so chosen; and if either party shall refuse to choose a referee, an umpire shall be appointed by the Supreme Judicial Court; and the said Fitchburg Railroad Company shall receive the proceeds of said sale; but upon the express agreement however, that all the proceeds of said sale, or a sum equal thereto, shall be, or shall have previously from the funds of the Fitchburg Railroad Company been, applied to the purchase of real estate for railroad purposes upon or immediately connected with the road of the Vermont and Massachusetts Railroad Company and in its name, but for the occupancy of the Fitchburg Railroad Company as lessee, or to permanent and substantial improvements and such as are not in the nature of renewals or repairs, upon or connected with the road, road-bed, track, bridges, or real estate of the said Vermont and Massachusetts Railroad Company, or for the straightening or alteration of the line of the road of the Vermont and Massachusetts Railroad Company, or laying other tracks, or for the excess of cost of steel over iron rails, or for any, or all said purposes but for no other purpose whatever—Provided however, and it is expressly agreed, that if at the time of said sale, the one million and a half of bonds of the Vermont and Massachusetts Railroad

Proviso for  
disposition  
of the pro-  
ceeds.

Company—being the amount hereinbefore agreed upon—shall have been issued, and are outstanding, the whole proceeds of said sale shall be applied to the purchase and extinction of said bonds, or to a sinking fund to be kept expressly for that purpose; and if at the time of said sale no part of said issue of one million and a half of bonds shall have been made—or if a part of said bonds have been issued, but the said issue with the proceeds of said sale do not amount to one million and a half dollars—the Vermont and Massachusetts Railroad Company shall not be required to issue said bonds to any greater amount, than the difference between the actual proceeds of said sale added to the bonds already issued, and the sum of one million and a half of dollars; and in case a part only of said bonds shall have been issued before the sale of said Branch, and the part so issued together with the proceeds of said sale exceeds the sum of one million and a half dollars, so much of the proceeds of said sale shall be applied to the payment of said bonds (or carried to a sinking fund) as will reduce the sum of said bonds and proceeds to one million and a half dollars, the investment in a sinking fund being regarded for the purposes of this clause, as payment and extinction, *pro tanto*, of said bonds.

And the Vermont and Massachusetts Railroad Company doth further covenant and agree, that as its now existing bonds and all other bonds hereinbefore provided for mature, it will, on request of the Fitchburg Railroad Company, duly issue new bonds to the extent of eighty per centum of those so maturing, at a rate of interest of six or seven per centum at the option of the Fitchburg Railroad Company, to be sold at not less than par, and the proceeds to be applied to the payment to that extent of the bonds so maturing. And the said new bonds, if required, shall be delivered, at least six months before the maturity of the existing bonds, to a committee consisting of an equal number from the board of Directors of each of said Companies, to be by them sold and the proceeds strictly applied to the payment of the maturing bonds. And

Covenant  
to issue  
bonds in  
renewal.

the existing bonds shall be delivered up, when paid, to the Treasurer of the Vermont and Massachusetts Railroad Company, cancelled. And upon the maturity of all the bonds so issued in renewal by the Vermont and Massachusetts Railroad Company as provided in this agreement, the Vermont and Massachusetts Railroad Company shall, upon request of the Fitchburg Railroad Company, issue new bonds to the extent of seventy-five per centum of the whole amount so maturing, of like tenor, and in such due season, as to enable the Fitchburg Railroad Company to liquidate and pay seventy-five per centum thereof. And when again such new bonds mature, the Vermont and Massachusetts Railroad Company will again issue bonds of like tenor to the amount of two-thirds of the amount so maturing. And when said last named bonds mature, will again issue new bonds of a like tenor to the amount of one-half of the bonds so maturing; it being always understood and agreed, that the difference in each case, which is twenty per centum of the original issue, shall be paid from the funds of the Fitchburg Railroad Company. The time during which said bonds shall run in each case of issue shall not exceed twenty years.

And the said Vermont and Massachusetts Railroad Company hereby covenants and agrees with the Fitchburg Railroad Company that it will, at all times, upon the written request of the Fitchburg Railroad Company, make application to the Legislatures of Massachusetts or Vermont for all such acts and authority as may be necessary in the premises, and do all things which may be necessary or proper to enable the Fitchburg Railroad Company to procure the money necessary for the purposes aforementioned, in the manner above mentioned. But all acts of the Vermont and Massachusetts Railroad Company under this clause shall be at the cost and expense of the Fitchburg Railroad Company.

*And in consideration of the foregoing the said Fitchburg Railroad Company doth hereby covenant and agree to pay to the said Vermont and Massachusetts Railroad Company as*

Covenant  
to apply to  
the Legisla-  
tures for  
necessary  
authority.

Covenant  
for rent.



annual rent, for the first two years, a sum each year equal to four per centum per annum on the present amount of the capital stock of the said Vermont and Massachusetts Railroad Company, two million, eight hundred and sixty thousand dollars; for the third and fourth years a sum each year equal to five per centum per annum upon said capital stock; and for each year of the remainder of said term of nine hundred and ninety-nine years, a sum equal to six per centum per annum, upon said capital stock. And the said rent is payable semi-annually on the first days of April and October of each year of said term, in good and lawful money of the United States, and is to commence on the first day of January, A. D. 1874, and is payable at the office of the Treasurer of the Vermont and Massachusetts Railroad Company. The rent on the first day of April, A. D., 1874, is to be for three months and not for six months.

And the said Fitchburg Railroad Company doth further covenant and agree to pay the interest on the bonds of the Vermont and Massachusetts Railroad Company as it may accrue, and the principal thereof when due, and also all the installments of the sinking fund, and in the event that any of the convertible bonds of the said Vermont and Massachusetts Railroad Company shall be converted into stock, the said Fitchburg Railroad Company doth agree to pay, as additional rental, the same annual per centum on said new stock as is hereinbefore set forth and provided as to the other stock, and at the same place and time.

And the said Fitchburg Railroad Company agrees to pay to the Vermont and Massachusetts Railroad Company the sum of three thousand dollars annually, for the purpose of defraying the expenses of the maintenance of its organization and the salaries of its officers; said amount to be paid in equal quarterly payments.

And the said Fitchburg Railroad Company, further agrees to pay all taxes, whether national, state, county or municipal, which shall be assessed upon said Vermont and

Massachusetts Railroad Company, or upon its railroad, or any of its property, or which shall be required to be paid by said Vermont and Massachusetts Railroad Company for any year or part of year during said term; and if at any time during said term a tax shall be assessed upon the stock of the party of the first part, as a tax on property of stockholders, and as a substitute for the tax or any part thereof now levied upon the corporation, the party of the second part hereby agrees to pay the same, as also all charges and assessments in the nature of taxes, so that the party of the first part shall receive the clear annual revenue hereinbefore stated and fully set forth.

Covenant  
to expend  
money de-  
rived from  
sales of  
land.

And the said Fitchburg Railroad Company further agrees to expend all sums of money received from sales of land, or an amount equal thereto as hereinbefore fully set forth, in permanent improvements upon, or connected with, the road or real estate of the Vermont and Massachusetts Railroad Company and such as are not in the nature merely of renewals or repairs.

Covenant  
to indemnify,  
and save  
Lessor  
harmless.

And the party of the second part doth further agree to assume all the debts, claims, liabilities, and obligations of every nature and description, now incurred and outstanding against the said Vermont and Massachusetts Railroad Company, or that may in any way hereafter arise or grow out of any transactions, business, negligence, or misfeasance had or committed by said Vermont and Massachusetts Railroad Company prior to the first day of January in the year of our Lord one thousand eight hundred and seventy-four, and to forever indemnify and wholly save harmless the said Vermont and Massachusetts Railroad Company therefrom. And the said party of the second part further agrees fully to indemnify, and save harmless, the party of the first part from and against all claims, obligations, losses, liabilities, or expenses, that it may in any wise incur, or become liable to, after said first day of January, that may in any manner arise, or grow out of, any transactions, business, negligence, or misfeasance in any way connected with the operation, management, or control of said leased road, or any of its property.

And whereas the said party of the first part has con- Covenant to perform contracts.  
tracts for business and other matters still unexecuted and open, the party of the second part doth hereby agree to assume and perform all such contracts and agreements, and to do, and to keep, all things therein to be kept and performed, and save the party of the first part harmless therefrom. And it is to have and receive all payments and benefits to be had and received by the party of the first part under and by virtue of the same.

Said party of the second part further agrees that it will Covenant to maintain, rebuild and replace.  
at all times keep, rebuild, and maintain said Railroad, its road-bed, bridges, superstructures, buildings, grounds, and fences, and every thing pertaining to the same, in as good repair and condition as it now is, and as the law may require. But nothing herein contained shall prevent the lessee from altering, taking down, or removing any structures on the premises; but in such case, and in place thereof, it shall on some part of the leased premises make other improvements or erect other structures, equal in value to the structures altered, taken down, or removed. And the said Fitchburg Railroad Company shall have the right to use all the rolling stock of Right to sell rolling stock.  
the Vermont and Massachusetts Railroad Company on and over its own road, or over any road where it can lawfully send its own cars; and may, at any and all times, sell the locomotives, tools, machinery, fixtures, other rolling stock, furniture, and other personal property herein leased, substituting other property of equal value therefor.

And the said party of the second part covenants and Covenant to discharge chartered obligations of Lessor.  
agrees that in managing and operating said leased road it will, as far as it lawfully may, assume and perform all obligations and duties to which it would be liable under the laws and the Charter of the Vermont and Massachusetts Railroad Company, in case the said Railroad was owned by said party of the second part, and make all returns that are or may be required by law of the Vermont and Massachusetts Railroad Company.

Passes to  
be issued.

And the party of the second part further agrees to furnish, during the term of this lease, to the officers for the time being of the Vermont and Massachusetts Railroad Company, not exceeding nine in number, free annual passes over the Fitchburg, and Vermont and Massachusetts Railroads, on regular passenger trains; the said officers taking the risk of all personal damage, detention, injury, or loss of baggage, from any cause whatsoever on said passage. And it also agrees that the stockholders of the Vermont and Massachusetts Railroad may pass free over said roads at any stockholders meeting during said term.

Forfeiture  
clause.

These presents are upon the condition, that if the said Fitchburg Railroad Company shall neglect or refuse to pay the rent herein reserved, or any part thereof, for more than six months after the same shall have become due—previous written notice of at least thirty days having been given by the President and Directors of the Vermont and Massachusetts Railroad Company that this neglect or refusal will be considered as a forfeiture of this lease—or if the said Fitchburg Railroad Company shall continue to neglect, or fail to perform, any or either of the covenants on its part to be performed, for more than six months after written notice from the President and Directors of the Vermont and Massachusetts Railroad Company of such neglect or failure, and that if continued it will be regarded as a forfeiture of this lease—then and in either of said cases, the said party of the first part may lawfully, at any time after the expiration of said six months and while such neglect or default continues, without further notice or demand, enter into and upon the leased premises, or any part thereof in the name of the whole, and repossess the same as of its former estate, and expel the party of the second part and those claiming under it, without prejudice to any remedies which might otherwise be used for arrears of rent or preceding breach of covenant.

Interest  
to be paid  
for rent in  
arrear.

And whenever payment of rent as hereinbefore provided shall be delayed, interest shall be paid by the party of the second part to the party of the first part, from the time when



such rent shall become due, at the rate of ten per centum per annum, up to the time that notice shall be given that such delay will be regarded as a forfeiture. But nothing herein shall be considered to work a forfeiture of this lease when the omission or delay on the part of the Fitchburg Railroad Company in performing any obligations hereunder—saving only the payment of the rent—results from causes reasonably beyond its control, or when, from any cause, such omission or delay ought not in equity to work a forfeiture; and nothing shall prevent the right of the Fitchburg Railroad Company to delay the payment of any claim or demand against the Vermont and Massachusetts Railroad Company which, for reasonable cause, it may choose to litigate at its own cost.

And the Fitchburg Railroad Company doth further agree, <sup>Covenant to render equivalent.</sup> that in the event of the forfeiture of this lease for breach of the condition thereof, and entry and repossession by the lessor, it will pay over, or render a sufficient equivalent for, the appraised value of the personal property herein assigned and made over, (upon the basis of an inventory thereof, made at the time of the execution hereof,) and for the locomotives, tools, machinery, fixtures, rolling stock, furniture, supplies, and other property which it shall have sold under the authority hereinbefore contained.

And the Fitchburg Railroad Company doth further <sup>Covenant to pay bonds.</sup> agree, that whenever, in pursuance of the terms of this agreement, the Vermont and Massachusetts Railroad Company shall issue its bonds as herein provided for, the Fitchburg Railroad Company will pay the principal and interest thereof as they may become due, and save the Vermont and Massachusetts Railroad Company harmless therefrom; and will <sup>To secure by mortgage.</sup> also, in the event that it places a mortgage or other lien upon its road, or upon its interest in the Vermont and Massachusetts Road, include and secure in said mortgage all said bonds outstanding and unpaid, and all issued in renewal of them or any part of them; and it doth further agree, that all the proceeds of said bonds, or a sum equal thereto, shall be

To purchase  
real estate  
or expend  
in improve-  
ments.

or shall previously from the funds of the Fitchburg Railroad Company have been, applied to the purchase of real estate for railroad purposes, upon or immediately connected with the road of the Vermont and Massachusetts Railroad Company and in its name, but for the occupation of the Fitchburg Railroad Company as lessee, or shall be applied to permanent and substantial improvements, and such as are not in the nature of renewals or repairs, upon or connected with the road, road-bed, bridges, track, or real estate of the said Vermont and Massachusetts Railroad Company, or to the straightening or alteration of the line of the road of the Vermont and Massachusetts Railroad Company, or to laying other tracks, or to the excess in the cost of steel over iron rails, or to any and all said purposes, but to no other purpose whatever.

Covenant  
to apply  
proceeds of  
sale of real  
estate.

And the Fitchburg Railroad Company doth further agree, that whenever the Vermont and Massachusetts Railroad Company shall sell any portion of its real estate as hereinbefore provided for, the proceeds thereof, or a sum equal thereto, shall be, or shall previously from the funds of the Fitchburg Railroad Company have been, applied to the purchase of real estate, for railroad purposes, upon or immediately connected with the road of the Vermont and Massachusetts Railroad Company and in its name, but for the occupancy of the Fitchburg Railroad Company as lessee; or shall be applied to permanent and substantial improvements, and not such as are in the nature of renewals or repairs, upon or connected with the road, road-bed, track, bridges, or real estate of the said Vermont and Massachusetts Railroad Company, or to the straightening or alteration of the line of the road of the Vermont and Massachusetts Railroad Company, or to laying other tracks, or to any and all said purposes, but to no other purpose whatever.

Limitation  
of bonds  
and sales to  
one and a  
half million  
of dollars.

Provided however, and the Fitchburg Railroad Company doth further agree that if at the time of the sale of the Brattleboro Branch as hereinbefore provided for, the one million and a half of bonds of the Vermont and Massachusetts

Railroad Company—being the amount hereinbefore agreed upon—shall have been issued and are outstanding, the whole proceeds of said sale, or sales, shall be applied to the purchase and extinction of said bonds, or to a sinking fund to be kept expressly for that purpose.

And the said Fitchburg Railroad Company doth further agree, that in case a part only of said bonds shall have been issued before the sale of said branch, and the part so issued together with the proceeds of said sale exceeds the sum of one million and a half of dollars, so much of the said proceeds of said sale shall be applied to the payment of said bonds (or carried to a sinking fund) as will reduce the sum of said bonds and proceeds to one million and a half of dollars, the investment in a sinking fund being regarded for the purpose of this clause, as payment and extinction, *pro tanto*, of said bonds.

And the Fitchburg Railroad Company agrees, at all times upon the request of the Directors of the Vermont and Massachusetts Railroad Company, to furnish the said Directors with a full and detailed account of all expenditures, by said Fitchburg Railroad Company, of the money received from all its sales of the lands of the Vermont and Massachusetts Railroad Company, its sale of said Brattleboro Branch if made, and from the sale of any bonds issued or renewed under the provision of this lease.

It is further agreed and understood between the parties hereto, that the Fitchburg Railroad Company may relocate or rebuild any part of the line of the Vermont and Massachusetts Railroad, and for the purpose of straightening the same, or improving the grades or curvatures, may discontinue any portion, so far as it can lawfully be done, and may construct a second track in whole or in part, sidings, stations, and, in general, may make any reasonable and proper alterations, additions or improvements on said property, which the said Vermont and Massachusetts Railroad would, if acting in its own corporate capacity, have power to do. All however is to be paid for by the Fitchburg Railroad Company either out of its own funds, or out of the funds to be raised from bonds or otherwise as herein provided.

Covenant  
to account.

Lessee may  
relocate or  
rebuild.

Inventory  
and ap-  
praisals.

In addition to the inventory of the personal property assigned and made over as above provided, there shall be another inventory and appraisal made at, or immediately after, the execution of this lease, of all the locomotives, cars, rolling stock, machinery, and personal property of every nature and description demised to the Fitchburg Railroad Company by this lease, and an accurate description and appraisal made of the road, tracks, buildings, bridges, and all similar property appertaining to and of the nature of real estate, of the Vermont and Massachusetts Railroad Company; and a copy of such inventory, description, and appraisals shall be furnished to each of said Companies; and the same shall be evidence in any and all cases in which the question of the value of said property at the time of making this lease shall arise. The said inventory, description, and appraisals, as also the other inventory and appraisal provided for in this lease, shall be made by two disinterested persons, one selected by each of said Companies, who in case of any dispute or disagreement may choose a third.

Lease de-  
termining  
without de-  
fault,  
parties to  
be restored  
to former  
condition.

And if at any time it shall happen that this lease shall be or become invalid, or shall be terminated without the default of either party, then, and in such case, each party shall be restored as near as may be to the condition in which it stood before the lease was made, and due allowance shall be made for what each party has paid, received, or become liable for in consequence of this lease, or in carrying out its provisions, so as to make an equitable adjustment between them, (but in no case shall any rent be returned, it being understood that the rent and the value of the occupation shall be considered as mutually equivalent) and if the parties cannot agree upon such adjustment, or upon an arbitration, then the party aggrieved shall have a claim to relief at law or in equity.

Covenants  
binding on  
assigns.

All the covenants by either corporation shall be binding upon its successors and assigns, and all the covenants to or with either corporation shall enure to the benefits of its successors and assigns in the same manner as if in each case it had been fully expressed.



**In Witness Whereof**, the Vermont & Massachusetts Rail Road Company by its President, and the Fitchburg Rail Road Company by its President, the President of each of said Companies being thereto duly authorized as a committee, have to this, and one other instrument of even date and tenor herewith, signed their corporate names, and affixed their corporate seals, the year and day first above mentioned.

Witness to Daniel S. Richardson, President,  
and William B. Stearns, President, and  
Franklin N. Poor, Treasurer, and M. D.  
Benson, Treasurer.

FRANCIS B. SNOW.

Vermont and Massachusetts Rail Road Company, by Daniel S. Richardson, President, hereto authorized as a Committee by the Directors.

{ L. S. }

Fitchburg Rail Road Company, by William B. Stearns, President, hereto authorized as a Committee by the Directors.

{ L. S. }

Countersigned by

Franklin N. Poor, Treasurer Vermont & Massachusetts Railroad Company.

Countersigned by

M. D. Benson, Treasurer Fitchburg Rail Road Company.

# COMMONWEALTH OF MASSACHUSETTS.

SUFFOLK, ss., January 7th, 1874.

Then personally appeared William B. Stearns, and as President of the Fitchburg Railroad Company, and as a committee duly authorized thereto, acknowledged the above to be the free act and deed of the Fitchburg Railroad Company.

Before me

P. E. TESCHEMACHER, *Justice of the Peace.*

## COMMONWEALTH OF MASSACHUSETTS.

SUFFOLK, ss., January 7th, 1874.

Then personally appeared Daniel S. Richardson, and as President of the Vermont and Massachusetts Railroad Company, and as a committee duly authorized thereto, acknowledged the above to be the free act and deed of the Vermont and Massachusetts Railroad Company.

Before me

P. E. TESCHEMACHER, *Justice of the Peace.*

This memorandum witnesses that the terms of the within lease, have, before its approval by the stockholders of the Companies therein named, been unanimously agreed upon by the Directors thereof, acting under votes of their respective boards, both in their official capacity and as representatives of their respective boards.

Witness to the signatures  
of the Directors of the Ver-  
mont & Mass. Railroad Co.  
B. D. LOCKE.

Daniel S. Richardson,  
Geo. F. Fay,  
F. Goodhue,  
Wendell T. Davis,  
T. K. Ware,  
Jas. A. Dupee,  
Wm. H. Hill,

} *Directors of*  
} *Vermont and Massachusetts*  
} *Railroad Company.*

Witness to the signa-  
tures of the Directors of  
the Fitchburg R. R. Co.  
THOMAS WHITEMORE.

Wm. B. Stearns,  
Robert Codman,  
Seth Bemis,  
P. B. Brigham,  
Alvah Crocker,

} *Directors of the*  
} *Fitchburg Railroad*  
} *Company.*

Extracts from the Directors' Records of the Fitchburg Railroad Company.

The following vote was passed at a meeting held December 18th, 1873:

"Voted: That it is expedient to call a Special Meeting of the stockholders of the Fitchburg Railroad Company, to be held at the Passenger Station on Causeway Street, Boston, on Wednesday, the 31st day of December 1873, at 11 o'clock A. M., to see if the stockholders will authorize the Directors to take a lease of the Vermont and Massachusetts Railroad and its branches, for nine hundred and ninety-nine years, and to act upon the terms thereof; and the Clerk is hereby directed to call the same."

The following vote was passed at a meeting held December 29th, 1873.

"The proposed lease of the Vermont and Massachusetts Railroad having been presented and read, on motion of Mr. Bemis, seconded by Mr. Crocker, it was voted that this board do agree to said lease and approve the same, subject to the approval of the stockholders."

Extract from the Stockholder's Records of the Fitchburg Railroad Company.

The following vote was passed at a Special Meeting of the stockholders of the Fitchburg Railroad Company, held Wednesday, the 31st day of December, 1873: "That whereas the Directors of the Vermont and Massachusetts Railroad Company, and the Directors of the Fitchburg Railroad Company, whose roads enter upon and connect with each other, have agreed that the first named Company, shall make a lease of its road to said last named Company, and that such lease shall be for the term of nine hundred and ninety-nine (999) years, from the first day of January A. D., one thousand eight hundred and seventy-four, and that in addition to the payment of certain taxes, assessments and other payments to be made, and liabilities to be assumed and fulfilled by the lessees under said lease, the rent of such road, to be paid half yearly by said lessees, shall be a certain per cent-

age upon the Capital Stock issued by the said Vermont and Massachusetts Railroad Company, viz: Four per cent. per year thereon for the first two years of said term, five per cent. a year thereon for the two next years of said term, and six per cent. a year thereon for the residue of said term. And whereas the said Directors have agreed upon all the terms of said lease, which are fully set forth in the draft of a lease, this day submitted to the stockholders of the Fitchburg Railroad Company."

"Now therefore, we, the stockholders of the Fitchburg Railroad Company, do sanction and confirm such agreement, and do hereby approve of the terms of said lease, and do approve, ratify and confirm such lease itself, and hereby authorize the Directors of the Fitchburg Railroad Company in its behalf, either by their committee or collectively, to execute the same, and to affix thereto the signature and corporate seal of the Fitchburg Railroad Company."

Extract from the Directors' Records of the Fitchburg Railroad Company.

The following vote was passed at a meeting held January 7, 1874:

"On motion of Mr. Codman it was voted: That the President of this Company be authorized as a Committee to execute and acknowledge the lease of the Vermont and Massachusetts Rail Road, approved by the Stockholders at their Special Meeting held December 31, 1873, and to affix the corporate seal thereto."

I hereby certify that the foregoing are true copies from the Records of the Fitchburg Railroad Company.

*Attest :*

THOMAS WHITTEMORE,  
*Clerk of the Fitchburg Railroad Company.*



Extracts from the Directors' Records of the Vermont and Massachusetts Railroad Company.

The following vote was passed at a meeting, held December 19, 1873:

"Voted: That a Special Meeting of the Stockholders of the Vermont and Massachusetts Railroad Company be called, to be held at the Passenger Station of the Fitchburg Railroad Company, on Causeway street, in Boston, the sixth day of January next, at eleven o'clock A. M., to see if the Stockholders will authorize the Directors to lease the Vermont and Massachusetts Railroad and its branches, for nine hundred and ninety-nine years, and to act upon the terms thereof."

The following vote was passed at a meeting held January 6, 1874:

"The lease of the Vermont and Massachusetts Railroad to the Fitchburg Railroad Company, as agreed upon by the joint Boards of Directors, was submitted to the Board, and thereupon the following vote was unanimously passed, viz: Voted: That this Board agrees to said lease and approves the same subject to the approval of the Stockholders."

Extract from the Stockholders' Records of the Vermont and Massachusetts Railroad Company.

The following vote was passed at a Special Meeting, held January 6, 1874:

"*Whereas*, the Directors of the Vermont and Massachusetts Railroad Company, and the Directors of the Fitchburg Railroad Company, whose roads connect with each other, have agreed upon a lease by the first named Company, of its road to the last named Company, for the term of nine hundred and ninety-nine years, from the first day of January, in the year one thousand eight hundred and seventy-four, and upon all the terms thereof, a copy of which lease has this day been read and submitted to the stockholders of the Vermont and Massachusetts Railroad Company."

"Now therefore, we, the stockholders of the Vermont and Massachusetts Railroad Company, do sanction said lease, and do approve the terms thereof, and do hereby authorize the Directors of the Vermont and Massachusetts Railroad Company, in its behalf, either by their committee or collectively, to execute the same, and to affix thereto, the corporate seal of the Vermont and Massachusetts Railroad Company."

Extract from the Directors' Records of the Vermont and Massachusetts Railroad Company.

The following vote was passed at a Meeting held January 7th, 1874:

"Voted; That the President of this Company be authorized, as a committee, to execute and acknowledge the lease to the Fitchburg Railroad Company, approved by the stockholders, at their Special Meeting, held January 6th, 1874, and to affix the corporate seal thereto."

I hereby certify that the foregoing are true copies from the Records of the Vermont and Massachusetts Railroad Company.

*Attest :*

B. D. LOCKE,

*Clerk of the Vermont and Massachusetts Railroad Company.*







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R E P O R T

ON

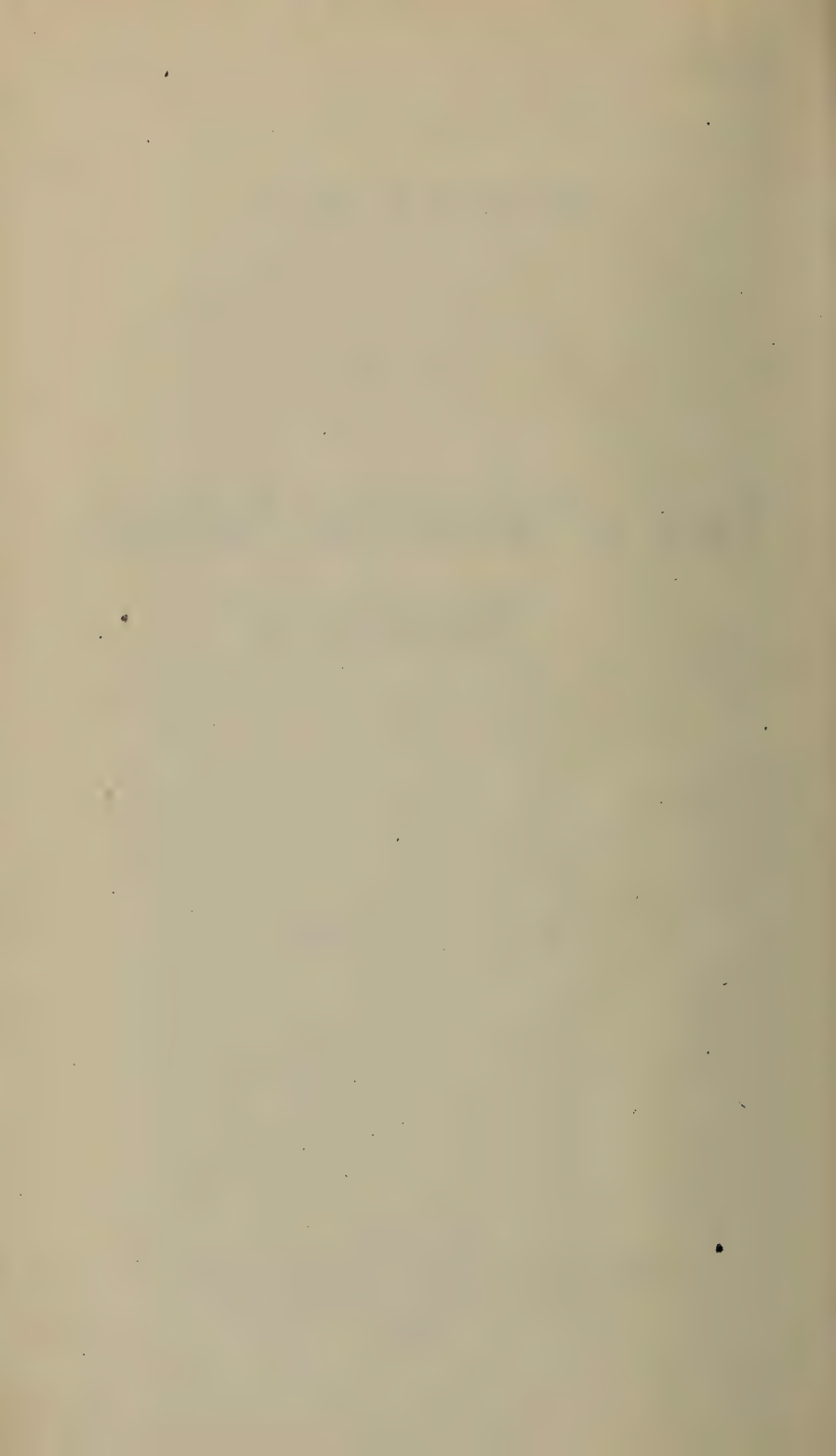
TROY & GREENFIELD RAILROAD  
SURVEYS.

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JANUARY, 1874.

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BOSTON:  
WRIGHT & POTTER, STATE PRINTERS,  
CORNER OF MILK AND FEDERAL STREETS.  
1874.



# Commonwealth of Massachusetts.

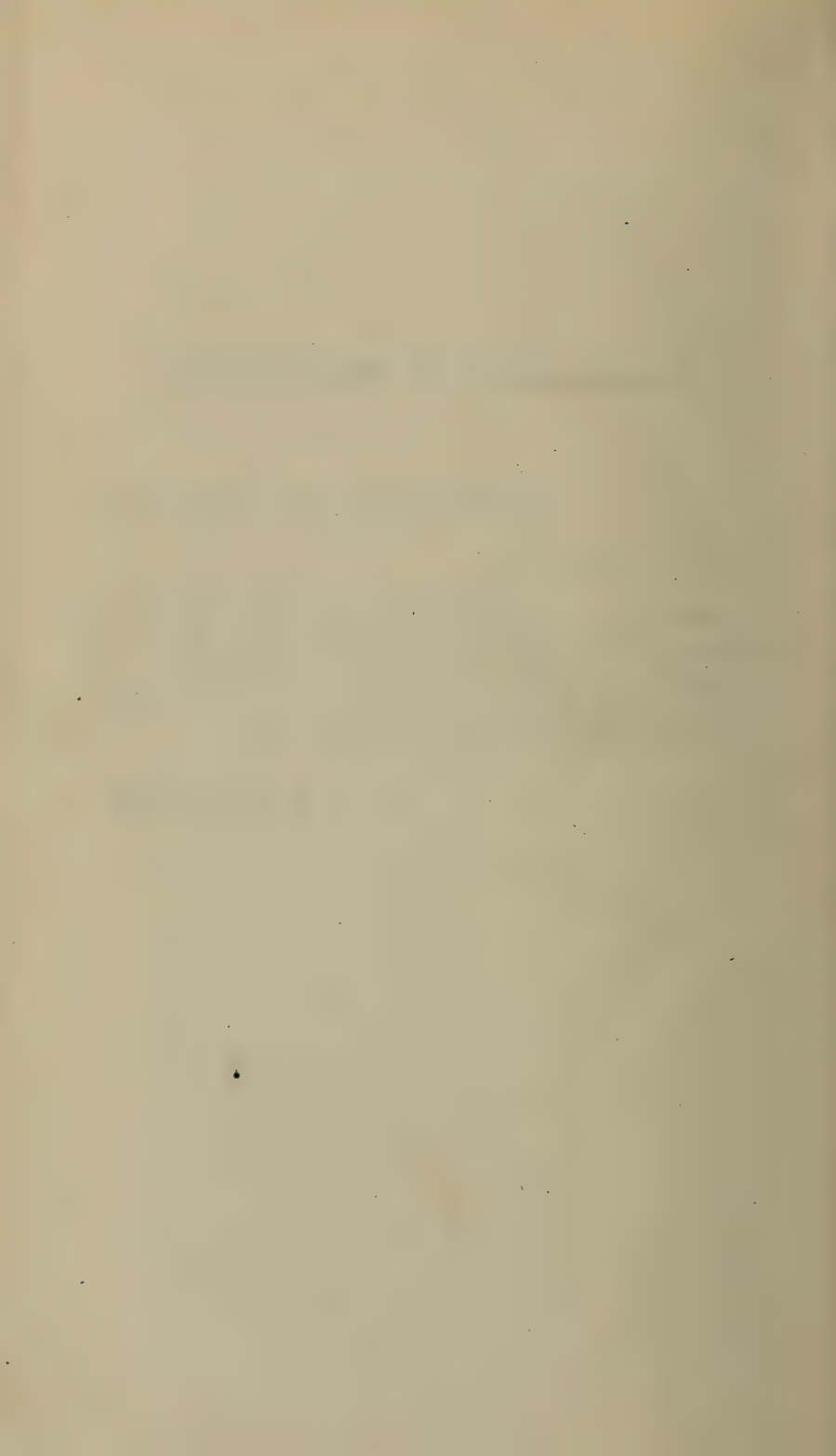
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EXECUTIVE DEPARTMENT, BOSTON, 20th January, 1874.

*To the House of Representatives.*

I have the honor herewith to lay before the General Court a Report of Surveys and Investigations relative to the Troy & Greenfield Railroad, made by Edward S. Philbrick, Civil Engineer, under instructions from the Governor and Council, given in pursuance of chapter 346, Acts of 1873.

W. B. WASHBURN.







MAP SHOWING  
Proposed changes of location  
in the  
**TROY & GREENFIELD R.R.**  
— EAST OF —  
**BARDWELL'S FERRY.**



## REPORT.

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To His Excellency WILLIAM B. WASHBURN, *Governor, and the Honorable Council.*

A sum was appropriated by the last general court, chapter 346, section 1, to be expended by the governor and council upon the Troy & Greenfield Railroad and Hoosac Tunnel, partly "in making such surveys and investigations as they may deem necessary to enable them to report to the next general court such plan as they think best for the interests of the Commonwealth to adopt in reference to said Tunnel and the Troy & Greenfield Railroad, and the probable cost of improving the same, and completing them for railroad service."

On the 5th of August last I was instructed to make such surveys and estimates as might be found necessary to a proper understanding of the case, and would now present my report.

I submit herewith a set of maps on a scale of 200 feet to an inch, showing present location of the Troy & Greenfield Railroad east of the Tunnel by a black line, and the proposed changes in blue and red lines; also a small map, to be printed herewith, showing alternative lines below Bardwell's Ferry by different surveys.

The history and general characteristics of the Troy & Greenfield Railroad are now tolerably familiar to a large number of our citizens. It is located in a narrow valley or gorge, alongside of a turbulent mountain-torrent, necessarily requiring very expensive works, and great thoroughness in their construction, to insure their permanence.

The original promoters of the enterprise were led, through lack of means, to bend all their energies upon keeping the first cost within certain limits, ignoring, or being unable to appreciate, the necessity of constructing durable work. So that, aside from the doubtful merits of the general location,



its details were carried out by the original company on a plan which was more commensurate with their means of payment, than likely to produce work suitable for future use.

The largest proprietor of the company being at the same time contractor and engineer, an unusual degree of concentration of talent and power was brought to bear upon the details of construction, which tended to produce a railroad line of the cheapest possible first cost, regardless of curvature and liability to wash, in a place requiring extraordinary expenditure to secure durability.

At the time when the State took possession of the property, so much work had been done in the construction, that it was thought best to complete it on the same general plan as begun, hoping it might stand till something better was needed; and since its completion the road has been kept passable, for the moderate amount of traffic developed, by dint of constant watchfulness and expenditure on the part of the lessees.

Some of the weak points in its construction were developed by the freshet of October, 1869, when the track was washed away, or rendered impassable, in fifty-nine separate places, some of which left gaps of five hundred feet length and sixty feet depth. More than half the culverts were torn out, and two spans of the bridge at Bardwell's Ferry carried off, with the pier between them.

The sum of \$142,160.21 was spent during the ensuing year by the lessees, and afterward refunded by the State, in repairing the line and rendering it passable. These repairs occupied a period of eleven months, during nine of which traffic was suspended.

Having been employed by His Excellency Governor Claflin, in June, 1870, to superintend these repairs, I made a report upon their completion, from which I quote the following, viz. :—

“The road is in some respects better able to resist the floods than ever before, inasmuch as new culverts have been built, in over twenty places, of largely increased opening, and on more secure foundations than before.

“But several miles of the embankment are exposed to the Deerfield River, a mountain torrent, which may at any time destroy all



such structures within its reach which are not thoroughly faced with stone.

“Several hundred carloads of loose rock have been picked up and applied to this purpose, so that, in this respect, the work is as well protected as before the great freshet of 1869, if not better, and therefore able to resist all ordinary stages of water.

“But another flood like that of October, 1869, or an unusual flood of even less dimensions, would be likely to destroy many of the embankments. There is scarcely any more broken stone left on the line of the road available for this sort of protection. I would therefore recommend an expenditure of some \$25,000 in bringing down the surplus stone from the Hoosac Tunnel as soon as a connection can be made with the present track.

“As the embankment this side of the tunnel will be finished during the coming year, at present rates of progress, a very large surplus of excellent material will become available for this purpose. Until such protection is effected, the road is at the mercy of the floods, and in no reliable condition for traffic.”

In pursuance of this recommendation, an appropriation of \$25,000 was made in 1872 (chapter 287) for applying the protection spoken of, but on examination it was found that the location of the road was so faulty in most of the points where protection was needed, that it was thought best to risk further interruption by freshets, until the proper time should arrive for improving the location, and properly protecting it.\* So that this sum was never drawn, nor any part of it.

During the past autumn I have inspected, on foot, every rod of the line from Greenfield to the Tunnel, not only for the purpose of forming an opinion of the present condition of the road, its safety and repair, but to study in detail such

\* Since writing the above, I read for the first time a description of this location by Mr. J. W. Brooks, in the Report of the Commissioners upon the Troy & Greenfield Railroad and Hoosac Tunnel, of February 28, 1863, which I now quote in corroboration of what I had written above:—

“The line, as now located, is essentially a contractors’ line,—such a one as might fairly be anticipated where the contractor and engineer were the same person, intensified, if possible, by his controlling a majority of the stock. Everything has apparently been sacrificed to save present outlay. That we do not advise the immediate abandonment of a considerable portion of it is because of the large amount of work already done upon the most objectionable parts of the line, and the small amount of business to be done upon it until the Tunnel is completed, to which period, under existing circumstances, its improvement may be wisely deferred.”—Page 27 *Commissioners’ Report*.

changes of location as might be necessary to bring the line up to some definite standard in regard to curvature, which might be suitable to a road likely to have a considerable traffic, and at the same time within reasonable limits of expense.

Its condition as to repair is quite as low as, if not lower than, is consistent with the safety of the limited business now done upon it. The sleepers are very much decayed, especially on the eastern half, below Shelburne Falls, and the rails are all worn out, except for such short distances as it has been found absolutely necessary to replace them with new iron, for the sake of safety, proving their wretched quality when new, while the embankments, never finished at a liberal width, or with suitable materials, have been continually slipping away since first built, and have been merely kept in a passable condition. Very few have any shoulders beyond the ends of the sleepers, while the sleepers themselves project, in some cases, the earth having slipped away from under their ends, which are supported by blocking. This narrowness of embankments is not due to recent river-wash, for there has been no freshet worth mentioning since 1869, but is attributable to the clayey soil of which, and the careless way in which, they were first built, and the lack of proper drainage of their slopes. The cuttings are in many instances of slippery clay, the slopes of which had never been properly protected or drained, which breaks off every winter and spring, covering the track in many places, filling the ditches for long distances, and rendering proper drainage of the road-bed impossible.

Under such circumstances, it is not surprising to find that the lessees, whose interest expires with the coming year, should have hesitated to spend more upon repairs than the obligations of their lease and a proper regard for safety required. This state of things follows as a natural consequence of the original imperfect construction, with subsequent occupation by lessees who have no interest or apparent obligation to maintain the condition of the road above the requirements of the immediate safety of their small traffic.

As to improvements to be made in the character of the curves, I have made a separate study of each curve, and have made cross-sections of the hill-sides, at intervals of 100 feet

or less, on all difficult ground, from which tolerably accurate estimates could be made of the quantities of earth or rock to be removed, or of wall to be built, to effect any desired change within reasonable limits.

In making up these estimates, I have taken first as a standard a minimum radius of 1,146 feet, or  $5^{\circ}$  per 100 feet, in five of the most difficult places, with a minimum of 1,432 feet radius, or  $4^{\circ}$  per 100 feet at other points. This is about the same standard as was adopted upon the Mountain Section of the Boston & Albany Railroad. This line is drawn in blue on the large maps submitted herewith.

It is to be observed that the sharpest curves occur, either on gradients descending, or but very slightly ascending, in the direction of the ruling traffic, moving eastward, so that their effect will not be found to limit the length or weight of freight trains. This will be governed by the maximum grade ascending eastward.

For this reason, and on account of the very great cost of attaining such a high standard, I have made another estimate on a line drawn in red ink upon the large maps, using as a standard a minimum radius of 955 feet ( $6^{\circ}$  per 100 feet) in four of the most difficult places. This estimate gives a total cost of \$1,510,300, while the blue line, using a larger radius in four places, costs \$161,362 more, making in all \$1,671,662, exclusive of land damages.

In nearly all the changes on which I have estimated the cost, and which are represented on the accompanying large maps by the blue and red lines, it has been thought best to adopt the same general location that the old line is on, using the old land and grading for a large part of the way, the changes extending over 75 per cent. of the whole track, leaving 25 per cent. untouched, while of the 75 per cent. where changes occur a large part of the old work is used. By this means local interests have been protected, which might have been injuriously affected by a more radical change, for which change, with the exception named below, there seems to be no good reason. This is particularly the case with the whole of the portion above Bardwell's Ferry station. Below this point there are other lines to be considered, and a wider choice. Before deciding upon any definite course for future construc-



tion, farther examination should be made as to the merits of such other lines.\* There is an apparently very practicable line, formerly called the Deerfield Route, described by Mr. J. W. Brooks in his report, as follows:—

“ Another line was surveyed from the Vermont & Massachusetts Railroad to Bardwell’s Ferry. This line commences about  $1\frac{1}{3}$  miles east of the present terminus of the Troy & Greenfield Railroad, and keeping on the south side of the Deerfield River crosses the Connecticut River Railroad, south of the Cheapside Bridge over the Deerfield River; thence, nearly parallel with that road, to Deerfield Centre, and, crossing the Deerfield River at Martin’s Falls, it joins the present location at Bardwell’s Ferry.

“ The whole length of this line is  $8\frac{11}{100}$  miles; it has  $489^\circ$  less curvature, and 150 feet less rise and fall than the present route, and reduces the maximum grade ascending westward from  $58\frac{6}{10}$  to  $50\frac{16}{100}$  per mile; but this latter is not so important as might appear, for the grade ascending east, in the direction of the heaviest trade, is quite as strong relatively as the  $58\frac{6}{10}$  rising west in the present line.

“ Its adoption would involve the abandonment of  $7\frac{7}{10}$  miles of the present track; as a through line it would save a mile in distance.”

This Deerfield line was estimated by Mr. James Laurie, C. E., in his report to the commissioners, January 10, 1863, to cost \$220,000 for the  $8\frac{11}{100}$  miles. Assuming his estimate of quantities to be correct, and carrying them out at present prices for similar work, and adding for superstructure, we obtain a total of \$551,855, which is to be compared to the sum of \$593,615, and the land damages estimated as needed for an improvement of the present location east of the point of divergence as represented by the *blue* line on the large maps, and compared to the sum of \$578,455, as represented by the *red* line, between the junction of the Vermont and Massachusetts Railroad and a point common to both below Bardwell’s Ferry.

Thus the Deerfield line appears, not only to possess advantages over the present line with its improvements, both in distance and rise and fall, but actually costs \$26,600 less, if we may trust Mr. Laurie’s quantities, than the proposed

\*Two of these alternative lines are shown on the small map printed herewith.



improvements on the lowest standard as to curvature, and \$41,760 less than those on the highest standard on that portion of the old line which it is intended to replace.

Mr. Laurie, in his report to the commissioners (page 172), speaks of this line through Deerfield, as follows :—

“ Viewed as a through line, the saving of nearly a mile in distance, 489° of curvature, the reduction of the maximum grade and the avoidance of the Green River Bridge with its sharp curve would be of considerable importance.”

These advantages are to be weighed against the local business of Greenfield and Turner's Falls, which may be better accommodated otherwise.

For this end still another line has been surveyed recently (see small map printed herewith), which leaves the present line of the Troy & Greenfield Railroad about  $1\frac{1}{2}$  miles west of the present junction with the Vermont & Massachusetts Railroad, and passing through Greenfield and Turner's Falls, intersects the present Vermont & Massachusetts track at Grout's Corner. This line is found to be a trifle longer (565 feet) than the present through line, but accommodates Greenfield and Turner's Falls to good advantage. It requires about  $9\frac{3}{10}$  miles of independent construction, of which about two miles lie west of the Connecticut River Railroad, replacing nearly the same length of the present line of the Troy & Greenfield Railroad. This two miles, if built for a single track, would cost about \$166,000 less than the improvement noted on my large maps on that part of the line which would be replaced by it between Blakely Hollow and the present junction.

Although the northern line is slightly longer as a through line than the present one, the large local interests at Greenfield and Turner's Falls may do much towards its construction; while the greater chances of developing business from these towns by building a thoroughfare *through* them, than by having them on one side, merits due consideration. The portion of this line lying east of the Connecticut River Railroad is estimated by Mr. Wm. P. Granger, C. E., who made the surveys, to cost \$361,000 for a single-track line and wooden bridges.

For the sake of exhibiting in a concise form the nature of

the changes contemplated, and the comparative merits, as to curvature, of other lines in mountainous districts, I have prepared tables, which will be found in the Appendix.

As to the propriety of bringing the location of this line up to either of the standards upon which these estimates are based, there may be some difference of opinion even among experts. Some arbitrary standards must be taken for the purposes of a preliminary estimate, though it may be found perfectly proper to depart from these, in construction, in extreme cases, where the large expense to be incurred may prove incommensurate with the advantage to be gained.

Such questions can better be settled in detail whenever the work of construction shall be done.

In deciding such questions, it should be borne in mind that a sharp curve, say of 1,000 feet radius, is not a serious obstacle to a freight traffic when it occurs upon gradients descending, or but slightly ascending in the direction of the heavy traffic, and nearly the whole of the thirty miles we are now considering, between Greenfield and the Tunnel, presents this mitigating feature.

Were a passenger traffic to be provided for, however, such curves would present an obstacle by limiting the speed at which trains could be moved with safety, especially when running along the edge of high declivities, beside adding considerably to the wear and tear of permanent way and rolling-stock.

As to the standard held in view in regard to permanence of work in the grading, masonry and bridging, I do not anticipate much difference of opinion, though a large expense may be incurred. All the leading railroad lines in the country have, after twenty years' experience, abandoned wood as an improper material for bridge-building, whenever the traffic has developed to any considerable importance. The building of wrought-iron bridges has in the same time had a large development, in which many reliable firms are now engaged. Some of the first efforts in this direction were failures, having been constructed without sufficient allowance for the depreciation of metal under vibration, and such cases have done much to throw iron bridges into disrepute; but the more recent works have generally been governed in this respect by

the rules adopted by the English and French governments for similar cases, promising entire safety for a long period, while the workmanship of American artisans is not excelled by any in other countries.

As to permanence in grading and masonry, it is hardly necessary to point out the folly of constructing such work upon improper principles or on insecure foundations. The experience of the past five years has shown to all who have observed the character of the Deerfield River, that it is a stream not to be trifled with or ignored with impunity.

In judging of the propriety or necessity of making such improvements in the Troy & Greenfield Railroad, the only question seems to me to be as to the *time* when it shall be done. There is no doubt that the present line is good enough for present traffic, and with a few months' work with a gravel train and a renewal of the track and some additional sidings, it would doubtless answer very well for as large a freight traffic as can be conducted on a single line of rails.

But if it be taxed with any considerable passenger traffic, with such an increase of freight as may very likely be developed after opening the Tunnel, a double line of rails from Troy to Fitchburg will become indispensable. The changes of location and the work of grading for a double track, can be carried on to much better advantage *together* than *separately*, and as they will in all probability be demanded by the increase of traffic at one and the same time, it has, therefore, seemed best to me to make an estimate of the cost of both, which is herewith presented in detail.

Respectfully submitted by your obedient servant,

EDWARD S. PHILBRICK,  
*Civil Engineer.*

BOSTON, January 6, 1874.

# APPENDIX.

*Summary of Estimate of Cost of the proposed improvements of the Troy & Greenfield Railroad, as indicated by the blue line on the accompanying Map.*

MATERIAL.	FOR SINGLE TRACK.			FOR DOUBLE TRACK.		
	Quantity—Yds.	Price.	Cost.	Quantity—Yds.	Price.	Cost.
Earth excavation, . . . . .	1,148,134	\$0 45	\$516,660 00	1,496,545	\$0 45	\$673,445 00
Loose rock, . . . . .	7,948	1 00	7,948 00	10,438	1 00	10,438 00
Solid rock, . . . . .	144,391	2 00	288,782 00	216,244	2 00	432,488 00
Tunnel at North Adams, . . . . .	—	—	50,000 00	—	—	50,000 00
Pier masonry, . . . . .	2,548	20 00	50,960 00	3,596	20 00	71,920 00
Abutment masonry, . . . . .	12,288	15 00	184,320 00	15,591	15 00	233,865 00
Arches, . . . . .	5,997	15 00	89,955 00	8,545	15 00	128,175 00
Culverts, . . . . .	13,908	5 00	69,540 00	17,923	5 00	89,615 00
Retaining walls, . . . . .	12,703	4 00	50,812 00	25,000	4 00	100,000 00
Rip-rap, . . . . .	153,077	1 75	267,885 00	153,077	1 75	267,885 00
Bridges, . . . . .	—	—	94,800 00	—	—	217,700 00
				Grading, &c., on 6.65 miles west of North Adams, 43 $\frac{2}{3}$ miles at 2d track, 43 $\frac{2}{3}$ miles at \$11,000, . . . . .		
Total, . . . . .	. . . . .	. . . . .	\$1,671,662 00	Total, . . . . .	. . . . .	\$2,854,551 00



*Comparative Curvature of the Present Line of the Troy & Greenfield Railroad and the Proposed Line, drawn in Blue on Map.*

Degrees.	Radius—feet.	PRESENT LINE.		PROPOSED LINE.	
		Total Curvature.	Length of Curve—feet.	Total Curvature.	Length of Curve—feet.
1, . .	5,730	8° 21'	1,060	—	—
2, . .	2,865	198° 28'	10,888	121° 21'	6,785
3, . .	1,910	430° 56'	14,267	626° 11'	21,383
4, . .	1,432	735° 45'	18,807	1,533° 21'	39,834
5, . .	1,146	1,000° 49'	19,762	427° 23'	8,540
6, . .	955	1,125° 54'	19,044	—	—
7 to 11, .	819 to 522	486° 49'	6,071	—	—
—	—	3,987° 02'	89,899	2,708° 16'	76,542

*Present Line.*

Curvature per mile, . . . . . 133°  
 Percentage of line curved, . . . . . 56

*Proposed Line.*

Curvature per mile, . . . . . 90°  
 Percentage of line curved, . . . . . 49

Table showing saving by adopting 6° per 100 feet as sharpest curve, in place of 5°.

This contemplates the blue line to be modified as shown in *red* upon the map at four places, viz., Bardwell's Ferry bridge, West Deerfield, above Zoar, and near the tunnel station. Whole length of line changed, 9,490 feet. Total amount of curvature not changed.

*Red Line, for Single Track.*

Saving of Material.	Quantity.	Price.	Saving of Cost.
Rock, . . . . .	41,531 yards, .	\$2 00	\$83,062 00
Pier masonry, . . . .	980 " .	20 00	19,600 00
Abutment masonry, . .	1,780 " .	15 00	26,700 00
Bridging, . . . . .	400 lineal feet,	80 00	32,000 00
Total saving, as compared with blue line, . . . .			\$161,362 00

*Double Track. Saving by adopting Red Line in place of Blue.*

Saving of Material.	Quantity.	Price.	Saving of Cost.
Rock, . . . . .	57,923 yards, .	\$2 00	\$115,846 00
Pier masonry, . . . .	980 " .	20 00	19,600 00
Abutment masonry, . .	1,780 " .	15 00	26,700 00
Bridging, . . . . .	500 lineal feet,	80 00	40,000 00
Total saving, as compared with blue line, . . . .			\$202,146 00

*Comparison of Lines via Greenfield and via Deerfield.*

M A T E R I A L S.	JAS. LAURIE'S LINE VIA DEERFIELD.			BARDWELL'S FERRY TO JUNCTION* VIA GREENFIELD. PRESENT JUNCTION.		
	Quantity.	Price.	Value.	Quantity.	Price.	Value.
Earth and ballast, . . . . .	275,600 cub. yds.,	\$0 45	\$124,020 00	554,902 cub. yds.,	\$0 45	\$249,706 00
Solid rock, . . . . .	82,000 "	2 00	164,000 00	50,515 "	2 00	101,030 00
Loose rock, . . . . .	5,000 "	1 00	5,000 00	—	1 00	—
Box culverts, . . . . .	947 "	5 00	4,735 00	2,689 cub. yds.,	5 00	13,445 00
Arch culverts, . . . . .	2,484 "	15 00	37,260 00	5,267 "	15 00	79,005 00
Bank wall, . . . . .	500 "	4 00	2,000 00	4,055 "	4 00	16,220 00
Rip-rap, . . . . .	1,200 "	1 75	2,100 00	5,333 "	1 75	9,334 00
Road-bridge masonry, . . . . .	1,120 "	10 00	11,200 00	+1,445 "	20 00	28,900 00
River-bridge masonry, . . . . .	1,470 "	15 00	22,050 00	3,665 "	15 00	54,975 00
Foundations, . . . . .	—	—	1,500 00	—	—	—
Bridge superstructure, . . . . .	370 lin. feet,	80 00	29,600 00	500 lin. feet,	80 00	40,000 00
Road-bridge superstructure, . . . . .	100 "	15 00	1,500 00	—	—	1,000 00
Altering town roads, . . . . .	—	—	1,500 00	—	—	—
Farm-crossings and cattle-guards, . . . . .	—	—	2,000 00	—	—	—
Land damages, . . . . .	—	—	39,000 00	—	—	—
Fencing, . . . . .	3,700 lin. rods,	2 20	8,140 00	—	—	—
Track-laying, iron, &c., . . . . .	8.75 miles,	11,000 00	96,250 00	—	—	—
Totals, . . . . .	. . . . .	—	\$551,855 00	—	—	\$593,615 00

† Pier masonry.

\* Blue line on Map.

Comparative cost of line indicated in blue ink on map, from present junction of Vermont & Massachusetts Railroad to Blakely Hollow, with line of W. P. Granger, from Connecticut River Railroad to Blakely Hollow.

*Blue line on the Map for single track from Junction of the Vermont & Massachusetts Railroad to Blakely Hollow.*

Material.	Quantity.	Price.	Cost.
Earth, . . . . .	284,175 yards, .	\$00 45	\$127,879 00
Pier masonry, . . . .	1,445 " .	20 00	28,900 00
Abutment masonry, . .	2,747 " .	15 00	41,205 00
Arch masonry, . . . .	2,620 " .	15 00	39,300 00
Bridging, . . . . .	500 lineal feet,	80 00	40,000 00
Total, . . . . .			\$277,284 00

*Line of Survey of W. P. Granger, Blakely Hollow to Connecticut River Railroad, single track.*

Material.	Quantity.	Price.	Cost.
Earth, . . . . .	84,300 yards, .	\$00 40	\$33,720 00
Rock, . . . . .	3,735 " .	2 00	7,470 00
Bridge masonry, . . .	2,980 " .	15 00	44,700 00
Culvert masonry, . .	190 " .	5 00	950 00
Bridging, . . . . .	300 lineal feet,	80 00	24,000 00
Total, . . . . .			\$110,840 00



## Comparison with other Lines.

	Maximum grade per mille, rising easterly.	Maximum grade per mille, rising westerly.	Rise and fall.	Whole length.	Sharpest Curve.	Percentage straight.	Percentage curved.	Degrees of Curve per mille.	T. & G. R. R. Estimated cost of changes.
{ Troy & Greenfield R. R., present line, " " improved blue, " " improved red.	30.6	58	810	31.6*	10°	44	56	133	-
	23.8	50	767	30.8	5°	51	49	90	\$1,671,662
	23.8	50	767	30.8	6°	51	49	90	1,510,300
Troy & Greenfield via Deerfield to V. & M. R. R., . . . . .	-	50	660	30.3	6°	-	-	94	1,483,700†
Troy & Greenfield via Turner's Falls to C. R. R. line, . . . . .	-	50	749	-	5°	-	-	-	1,344,310†
Boston & Albany R. R., . . . . .	75	83	5,606	200	5°	-	-	41.1	-
Providence & Worcester R. R., . . . . .	-	-	582	43.4	8°	-	-	58.7	-

\* The distances in the column of "lengths" count from the eastern portal of the Hoosac Tunnel to a common point on the Vermont & Massachusetts Railroad  $1\frac{1}{2}$  miles south of the present junction.

† The cost set against the lines via Deerfield & Turner's Falls includes their construction from the east end of the Hoosac Tunnel, following the red line on the map, or the blue line where no red one is drawn, to the points of divergence; thence over the independent line via Deerfield to its junction with the Vermont & Massachusetts Railroad,  $1\frac{1}{2}$  miles south of the present junction, and upon the line towards Turner's Falls as far its intersection with the Connecticut River Railroad at Greenfield.

Between Hoosac Tunnel and  
Connecticut Valley.

*Comparison with other Lines—Concluded.*

	Maximum grade per mile, rising easterly.	Maximum grade per mile, rising westerly.	Rise and fall.	Whole length.	Sharpest Curve.	Percentage straight.	Percentage curved.	Degrees of Curve per mile.
Cheshire R. R., . . . . .	—	60	—	53.6	5°	—	—	59°
Fitchburg R. R., . . . . .	34.3	40.7	1,052	51.0	5°	—	—	33.2°
Vermont & Massachusetts R. R., . . . . .	48	58	1,798	69.0	5°	—	—	47.8°
Erie Railroad, Delaware Division, . . . . .	—	—	—	103.3	6°	—	54	88°
Baltimore & Ohio R. R., 4 divisions as below,* . . . . .	39.6	116.0	9,643	379	9° 33'	42	58	119°
“ Baltimore to Martinsburg, . . . . .	39.6	—	2,033	99	9° 33'	45	55	121°
“ Martinsburg to Piedmont, . . . . .	39.6	—	1,029	107	5° 42'	41	59	80°
“ Piedmont to Grafton, . . . . .	—	116.0	4,681	74	9° 33'	46	54	152°
“ Grafton to Wheeling, . . . . .	—	79.2	1,900	99	9° 33'	37	63	154°
Pennsylvania Central, . . . . .	52.8	95	—	—	8° 45'	—	—	—

\* I am indebted to Mr. B. D. Frost, C. E., for the information given above concerning the Baltimore & Ohio and Pennsylvania Central lines. The characteristics of the Massachusetts roads and the Erie Railway are taken from their official reports.



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HISTORY  
of the  
HOOSAC TUNNEL

Letters of J. S. Browne and  
W. B. Browne relating to  
Tunnel Topography,



